RUBBER WORLD

SERVING THE RUBBER INDUSTRY SINCE 1889

Butyl Tire Tread Abrasion

Gel Formation in SBR Polymers

Butyl Mooney Viscosity at 260° F.

Punched Cards Mechanize Job Costing

A BILL BROTHERS PUBLICATION

FEBRUARY, 1960

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News about

B.F.Goodrich Chemical *raw materials*

EXCEPTIONAL ABRASION RESISTANCE of new Hycar 1072 was first proved in laboratory test shown in this photo, then confirmed by field evaluation.

Gives outstanding abrasion resistance

HYCAR 1072

FINISHED parts made with Hycar 1072 have from four to ten times the abrasion resistance of parts made with typical nitrile rubbers. Gum tensile strength is unusually high. Ozone resistance is exceptional.

Hycar 1072 retains its good physical properties at elevated temperatures. High hardness and excellent physical properties can be obtained without the excessive loading that might otherwise interfere with good processing.

For further information on properties of Hycar 1072, write Dept. FB-2, B.F.Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

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B.F.Goodrich Chemical Company

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RUBBER WORLD

ARTICLE HIGHLIGHTS

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VOLUME 141, NUMBER 5 FEBRUARY, 1960

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Cover photo: Butyl Tire, courtesy of The Enjay Co.; Banbury Mixer, Farrel-Birmingham Co., Inc.; Mooney Viscometer, Scott Testers, Inc.; and Keysort Tabulating Punch, Royal McBee Corp.

The opinions expressed by our contributors do not necessarily reflect those of our editors

FEATURE DEPARTMENTS

Oil soluble, heat reactive...
PHENOL DIALCOHOL RUBBER CURATIVE

CATALIN RESIN 9273

A versatile, heat-reactive phenol dialcohol curing resin, supplied in lump form. It is highly compatible with Butyl and other synthetic rubbers and yields vulcanizates with *superior heat stability, high mechanical strength* and *low compression set values.* Vulcanizates cured with this resin resist reversion.

Catalin Resin 9273 can be readily milled with the rubber stock or in the compounding of adhesives, mixed with the solvent and premilled rubber. It is soluble in common solvents such as toluene and xylene.

Catalin Resin 9273 is produced with a carefully controlled methylol content, 9.0%-12.0%. Similar formulations with other methylol contents are available.

Catalin Resin 9273 is particularly useful in the production of steam hose, curing bags and bladders, belting for conveyors, tires, gaskets, grommets, cements.

Oil soluble, non-heat reactive
PHENOLIC RESIN RUBBER TACKIFIER

CATALIN RESIN 8318

A proven, non-heat reactive, oil soluble phenolic resin tackifier . . . highly compatible with SBR, Acrylonitrile, Butyl, Neoprene and natural rubber.

Catalin Resin 8318 is supplied in an easily used, crushed form and is highly soluble in common solvents such as aromatic hydrocarbons, ketones and drying oils. It can be milled with the rubber stock used in the production of tires and mechanical goods . . . or mixed with solvents and rubber for the production of pressure-sensitive cements.

This resin is also available in emulsified form and is designated Catalin Resin 9775

Catalin produces . . . at its three strategically located plants in the East, Mid-west and South . . . an almost infinite range of urea, phenolic, cresylic, melamine, resorcinol, and acrylic resin formulations for a wide group of industries.

In addition to rubber curatives and tackifiers, Catalin also produces one and two-stage phenolic and cresylic resin reinforcing agents, modified resins and antioxidants.

Literature, samples and technical assistance await your request.

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NEWS of the
RUBBER WORLD

The U. S. Food & Drug Administration advised the Rubber Manufacturers Association on January 26 that no industry-wide extensions under the Food Additives Amendment of 1958 would be granted. The FDA will consider petitions from individual manufacturers for extensions on a product-by-product basis. Deadline for filing a petition was February 1, 1960. The special RMA committee which is investigating this Amendment will seek to arrange a meeting of industry leaders with the Commissioner of FDA and his aides to try to determine exactly what the law will require of rubber manufacturers producing parts subject to the law.

The natural rubber industry has initiated technical service in the United States, as indicated in reports late last year. Effective February 1, 1960, the Natural Rubber Bureau appointed Ralph F. Wolf to its executive staff as Director of Technical Service. A small staff of technical service personnel will be added as time goes on to provide information resulting from increased research and development announced recently by the Malayan growers.

Overseas expansion of plants by suppliers to the rubber industry continues at a rapid pace. As we were going to press, United Carbon Co. announced plans to build a carbon black plant in Rouen in north central France. The new plant is expected to be on stream early in 1961 with an initial capacity of 50 million pounds per year and will cost about $5 million.

Witco Chemical Co. is also planning considerable expansion in its overseas operations. First step has been administrative and organizational changes in preparation for stepped-up expansion of plants in England and on the European continent.

United States Rubber Co. and Coleman Engineering Co., Inc., announced a rubber "skin" that promises increased speeds for any underwater vessels by reducing turbulence effects. The principle of this skin surface is expected to be of value in missile and rocket work as well as in underwater use currently being investigated.

TECHNICAL BOOKS

BOOK REVIEWS

"Bibliography of Rubber Literature for 1952-54." Editor-in-Chief, M. E. Lerner. Cloth, 6 by 9 inches, 793 pages. Published by the Division of Rubber Chemistry, American Chemical Society, Akron, O. Price, $7.50.

This tenth edition of the Rubber Bibliography is the third one to be issued spanning a three-year period. It reflects the tremendous increase in literature and patents pertaining directly to rubber in all of its manifold ramifications. It contains 9,169 references, against 6,412 in the previous edition, representing an increase of 43%.

The increase in references is reflected in practically every single classification. Some sections, however, show sharp increases, reflecting increasing attention to specific areas within the overall rubber industry. For example, the references in the poly(vinyl chloride) section increased from 309 to 603; those in physics from 124 to 241; those in processing operations from 85 to 215, and those in miscellaneous rubber products from 536 to 820. In a sense, the latter increase reflects the continued growth of the rubber industry itself.

This Bibliography is based on rubber references prepared at the United States Rubber Co., plus additional references culled from *Rubber Abstracts,* the journal published by the Research Association of British Rubber Manufacturers. Another source of information is *Revue Génerale du Caoutchouc,* the journal published by the French Rubber Institute. Some references are based on bulletins prepared by The B. F. Goodrich Co., the full use of which will be reflected in the next edition, covering the 1955-56 period.

The letter-number identification system originally conceived by Donald E. Cable, United States Rubber Co., has been continued; while the Journal Abbreviations used, with a few exceptions, follow those established by the American Chemical Society.

"ASTM Standards on Electrical Insulating Materials (with Related Information.)" ASTM Committee D-9 on Electrical Insulating Materials. 792 pages, hard cover, 6 by 9 inches. American Society For Testing Materials, Philadelphia 3, Pa. Price $7.00 to members; others, $8.75.

This edition contains 108 standards of which 46 are new, revised, or have had their status changed since the previous edition in 1957. While the majority of the standards in the compilation are the result of the work of ASTM Committee D-9 on Electrical Insulating Materials, a considerable number of the standards were formulated by other interested groups, notably Committee D-20 on Plastics. These standards have been included for completeness so that material published by the Society of interest to those in the electrical insulation field can be found in a single volume.

Among the topics covered are: insulating shellac and varnish; effects of radiation; plates, sheets, tubes, rods, and molded materials; ceramic products (glass, porcelain, steatite); solid filling, treating, encapsulating, and embedding compounds; flexible sheet, tape, and tubing; insulating papers; mica products; and magnet wire insulation.

"Elsevier's Rubber Dictionary in Ten Languages." Cloth, 6¼ by 8¾ inches, 1539 pages. Elsevier Publishing Co., New York, N. Y., 1959. Price, $60.00.

This compact volume contains some 8,000 terms relating to rubber, each appearing in ten languages (English/American,

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Technical Books

French, Spanish, Italian, Portuguese, German, Dutch, Swedish, Indonesian, and Japanese). These are terms used by engineers, technicians, and workers in the rubber industry, and they range from abdominal belt to zipper closed conveyor belt. Laboratory, office, and field terminology is thoroughly covered, and many types of equipment, processes, and materials are listed.

The basic word list is in English and is arranged alphabetically; British and American usage are clearly distinguished. The corresponding terms in the other nine languages are then given, arranged horizontally across two pages. In the second part of the dictionary alphabetical lists for each language give numerical keys to the basic English table. The typography, page layout, and thumb index facilitate swift reference.

For precise communication and exact translation or understanding of the literature, this dictionary should prove to be invaluable for all those working and dealing with rubber, whether in connection with research, management, production, or overseas trade.

NEW PUBLICATIONS

"Ty-Ply Rubber-to-Metal Vulcanizing Adhesives." Bulletin No. 1A. Marbon Chemical Division, Borg-Warner Corp., Washington, W. Va. 10 pages. This bulletin fully explains the various Ty-Ply types, general and detailed methods of use, bond characteristics and tie cements. Six types of Ty-Ply adhesives are covered.

"Hycar Rubber and Latex Specification Compounding." Manual HM-5. B. F. Goodrich Chemical Co., Cleveland, O. 94 pages. This technical data bulletin contains an introduction, and sections covering immersion fluids, aeronautical material specifications, automotive specifications, military specifications, miscellaneous specifications, and material suppliers. Data are presented in graphic and tabular form.

"National Forge Impact Testers for Plastics—Ceramics." Bulletin No. 523. Testing Machines, Inc., Mineola, L. I., N. Y. 4 pages. This colorful brochure illustrates the TMI impact tester for standard Izod and Charpy tests, on plastics and ceramics. Also included are two separate sheets on the new tension-impact test and the recently developed impact strength of adhesives tests. The folder further describes how four different tests can be performed on one basic testing machine by using various accessory items.

"Baker Industrial Trucks." Baker Industrial Trucks, division of Otis Elevator Co., Cleveland, O. These new four-page brochures describe and illustrate in detail Baker heavy-duty gasoline-powered fork trucks offering standard full-capacity lifts to 144 inches. These bulletins cover vehicles in 2,000-, 3,000-, 4,000-, 5,000-, and 6,000-pound capacities.

"New Concepts with Pneumatics." Bulletin #7-149. The Presray Corp., a subsidiary of Pawling Rubber Corp., Pawling, N. Y. This brochure presents construction and operating principles of the Presray Pneuma-Grip with detailed information, photographs, and line drawing illustrations. Also given is information on the Pneuma-Seal, including the formulation of a new radiation-resistant compound and applications such as hot and cold box sealing, dustfree enclosures, vacuum containers, and test cells.

"Hardness Testers." Testing Machines, Inc., Mineola, L. I., N. Y. 4 pages. This illustrated brochure describes the Wallace dead load hardness tester and the Wallace hardness meter. These instruments were designed to measure the hardness of rubber and rubber-like materials to laboratory standards of accuracy.

(Continued on page 602)

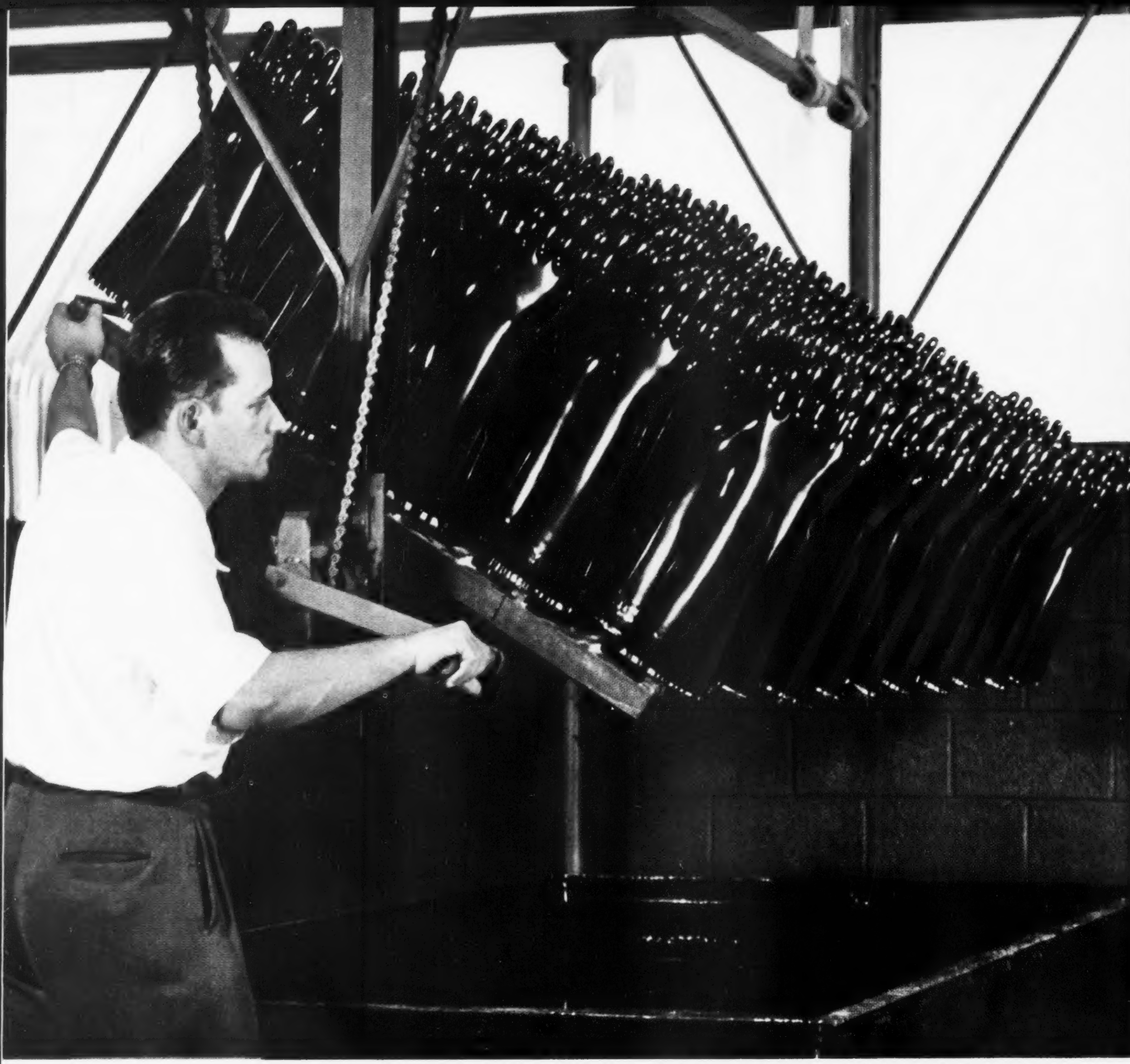


Photo taken through the courtesy of Charleston Rubber Company, Charleston, S. C.

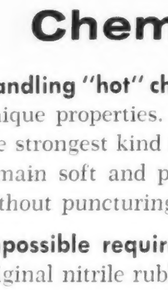
Chemigum gives protection with a "plus"

Handling "hot" chemicals calls for safety gloves with unique properties. Not only must these gloves resist the strongest kind of chemical action, they must also remain soft and pliant. They must offer this "plus" without puncturing, distorting or tearing.

Impossible requirements? Not for CHEMIGUM, the original nitrile rubber by Goodyear. A leading manufacturer in the field of safety wearing apparel has found that CHEMIGUM more than fills the bill of requirements, with the added advantage of exceptional oil- and solvent-resistance.

What's more, Chemigum is easy to process. It is readily milled – quickly forms uniform, stable, true molecular solvent solutions which, through multiple dipping, produce gloves of greater protective and wearing qualities.

If you can use an outstanding oil- and chemical-resistant rubber with outstanding processing properties, it will pay you to learn more about CHEMIGUM. For complete information–including latest *Tech Book Bulletins*–write: Goodyear, Chemical Division, Dept. N-9418, Akron 16, Ohio.



GOODYEAR
CHEMICAL DIVISION

Chemigum–T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

Photo courtesy Globe Rubber Products Corporation, Philadelphia, Pa.

Fashion floor that's built for kicks

Spiked heels may be stylish on the foot, but they're "murder" on floors. Car floors, particularly, take a beating – not only from the pointed fashions of modern footwear, but from the constant pounding of foot-loose youngsters.

To take it, car floor covers or mats must be tough. And to sell, they must have color. One of the leading manufacturers in this field has found that PLIOFLEX, synthetic rubber by Goodyear, has the lasting qualities they require. It has also enabled them to make a more sales-appealing product at a substantial saving.

Want proof? Just look at the clean, crisp color of the floor mat above. Consider, too, the assured processability of PLIOFLEX *plus* its high uniformity and exceptional resistance to aging.

It all adds up to economical production of a sales-appealing product. To add appeal to *your* product without adding to your costs, check the advantages of PLIOFLEX. For full information–plus latest *Tech Book Bulletins* on PLIOFLEX and a full range of synthetic rubbers and rubber chemicals–write Goodyear, Chemical Division, Dept. N-9418, Akron 16, Ohio.

GOODYEAR
CHEMICAL DIVISION

Plioflex–T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

Technical Books

(Continued from page 598)

"Air Processing." Bulletin No. S-5. J. O. Ross Engineering, division of Midland-Ross Corp., New York, N. Y. 12 pages. This bulletin includes data on such equipment as ovens, dryers, air heaters, and curing systems for use in such industries as pulp and paper, paint finishing, rubber and foam rubber, foundries, plastics, and chemical processing. It also includes six specific case histories covering tough drying or curing problems solved by properly engineered equipment.

"Reclaimed Rubber: Properties of Naugatuck Reclaims." Naugatuck Chemical Division, United States Rubber Co., Naugatuck, Conn. 20 pages. This new technical bulletin lists and describes the Division's reclaimed rubbers. Such reclaims are classified by scrap source and by application. Advantages and test recipes are also provided.

"Plastics: The Story of an Industry." The Society of the Plastics Industry, Inc., New York, N. Y. 42 pages. This booklet, an eighth revised edition, presents a brief overall picture of the entire plastics industry, touching on its history, development, types of companies, types of plastics, manufacturing processes, and products made by them. In addition there is reference to educational facilities, plastics trade publications, and publishers.

"Patents and Inventions—An Information Aid for Inventors." United States Government Printing Office, Washington 25, D. C. 30 pages. This pamphlet was developed in an effort to provide for the benefit of independent inventors and others, information as to patenting and patent procedures to help them in deciding whether to apply for patents, how to obtain patent protection, and in developing and marketing their inventions. Some 45 questions pertaining to this topic are answered.

"Lenz Hose Fittings." Lenz Co., Dayton, O. 8 pages. This illustrated catalog of hose fittings and hose gives specification tables for reusable hose fittings, assemblies, adapters, and single- and double-wire braid hose. Sections include such topics as single-wire braid-hose construction and specifications; single-wire braid-hose fittings; single-wire braid medium-pressure hose assemblies; also double-wire braid-hose construction, fittings, and assemblies; and hose adapters and swivels.

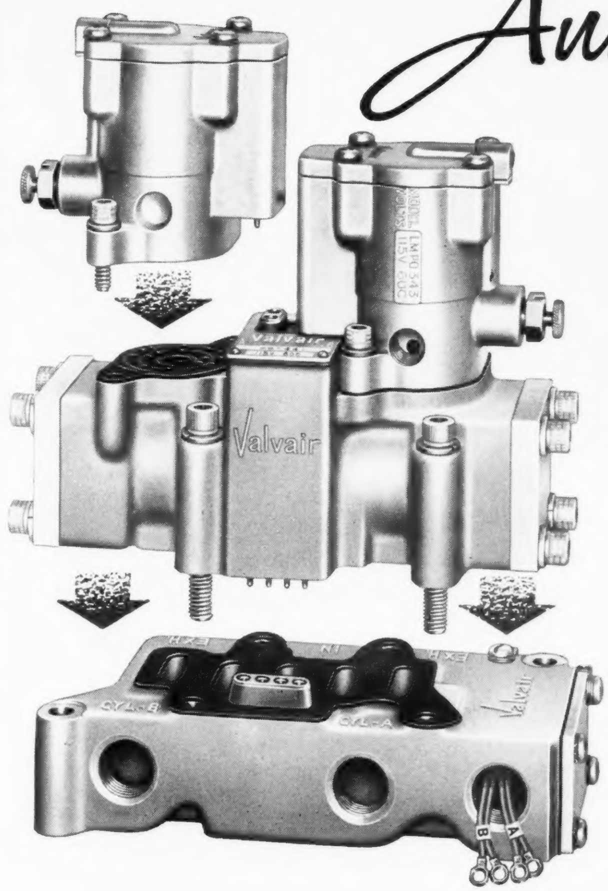
"D Series Chempumps." Bulletin 1080. Chempump division, Fostoria Corp., Huntingdon Valley, Pa. 4 pages. This two-color bulletin describes a new series of two-stage, high-head leak-proof "canned" pumps for heads up to 600 feet, temperatures to 850° F., and pressures to 3,500 psi.

"Riegel Riegelease." Riegel Paper Corp., New York, N. Y. 4 pages. This technical data bulletin is available in the form of an attractive file folder which describes various types of release and separating papers as well as the coatings required for a wide variety of applications. Such papers are used with polyvinyl ether masses, synthetic rubber and natural rubber adhesives, as well as for film castings, container liners, and for interleaving calking compounds and other tacky materials.

"C^{14}-Labeled Radiochemicals." General Catalog, Section 6. Research Specialties Co., Richmond, Calif. 46 pages. This illustrated catalog lists the firm's Carbon-14 labeled compounds including prices, discounts, ordering and licensing information, purity methods, and other pertinent data. It offers many license exempt packages and a special list of hydrocarbons.

"How American Ships Build U. S. Industrial Might." Committee of American Steamship Lines, Washington, D. C. 6 pages. This news bulletin contains a special rubber report showing how cargoliners help basic American industry. More than 500,000 tons of natural rubber are imported annually by cargoliners. Other information and illustrations are included.

(Continued on page 604)



Technical Books

(*Continued from page 602*)

Publications of Merck Marine Magnesium Division, Merck & Co., Inc., Rahway, N. J.:

"Maglite K in General-Purpose Non-Black Butyl Compounds Exposed to Sunlight." Bulletin No. 5917A. 4 pages. This report describes the benefits of incorporating Maglite K in non-black formulations. This specially calcined magnesia prevents or retards surface tack, dirt build-up, and surface cracking. The results are illustrated in tabular form.

"Maglites in Neoprene Adhesives." Bulletin No. 5919A. 4 pages. Maglite D and Maglite M in neoprene are said to aid in retarding scorch during mixing, lengthening the shelf life of the adhesive, and improving tack retention properties. Procedures for stock and adhesive preparation are included. There is also a comparison of the two grades of Maglites in Neoprene AC and Neoprene W adhesives.

Publications of the Office of Technical Services, Business & Defense Services Administration, United States Department of Commerce, Washington, D.C.

"Research on Elevated-Temperature-Resistant Inorganic Polymers Structural Adhesives." PB 131934. H. H. Levine, Quantum, Inc., for WADC, U. S. Air Force. 57 pages. Six promising compounds were prepared in work toward development of inorganic metal-to-metal adhesives stable at 1,000° F. All were stable from 750° F. to red heat, generally insoluble, and possessed very reactive atoms which might be capable of modifications resulting in adhesive properties.

"Research on Thermostable Molecules and Polymers." E. A. Lawton and D. D. McRitchie, Battelle Memorial Institute for WADC. 91 pages. PB 131663. Synthesis techniques for polymers containing the benzotetraazaporphin structure were studied in a search for organic compounds and polymers with high thermal stability. Various copper polybenzotetraazaporphins were prepared and found to be stable to about 530° C. in vacuum, but decomposed below 700° C.

"Development of Inorganic Polymer Systems." PB 131935. C. F. Gibbs, H. Tucker, G. Shkapenko and J. C. Park, B. F. Goodrich Co. for WADC. 61 pages. Semi-organic polymers based on an aluminum-oxygen-silicon system were studied in a program to develop an elastomeric material resistant to hydrolysis and oxidation and capable of operating at temperatures to 900° F.

"Materials, Techniques, and Economics of Foamed-in-Place Polyurethane Cushioning for Packaging." PB 151831. S. Childers, Materials Laboratory, WADC, U. S. Air Force. 35 pages. Cheap materials and simple techniques make it attractive for the manufacturer to mold his own foamed-in-place polyurethane cushioning for packaging delicate items, concludes this study. The report discusses such matters as the chemistry of foam reactions and foam systems. Foaming methods and equipment are also covered.

"Government Specifications Catalog." Magic Chemical Co., Brockton, Mass. 26 pages. This new edition of this catalog lists 1,000 Official United States Government Specifications covering adhesives, sealants, paints, cleaning compounds, and chemical compounds. The catalog is useful to purchasing and procurement officials of companies handling government contracts or those who need products conforming to government specifications. This edition is divided into eight sections according to Federal Class Numbers and has a complete numerical index.

"*Cis-Trans* Isomerization in Polyisoprenes—Part I," No. 318; **"Mastication—Part 9,"** No. 319; **"Stress Waves and Fracture Surfaces,"** No. 320; **"Radiochemical Studies of Free-Radical Vinyl Polymerizations, Parts I and II,"** No. 321; **"The Swelling of Rubber Networks in Binary Solvent Mixtures,"** No. 322; **"The Detection and Estimation of Thiosulfinates and Thiosulfonates,"** No. 323; and **"List of Publications 1940-1959 and Supplements."** Publications of The British Rubber Producers' Research Association, Welwyn Garden City, Herts, England.

(*Continued on page 606*)

Technical Books

(*Continued from page 604*)

Publications of the elastomer chemicals department, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.:

"'Viton' B." Report No. 59-4. By A. L. Moran. 16 pages. "Viton" B synthetic rubber is a new fluoroelastomer with even better thermal stability and fluid resistance than "Viton" A and A-HV. This bulletin gives a product description, vulcanizate properties, compounding ingredients, processing and vulcanization, and solution properties. Tables, charts, and graphs are included.

"Saran as a Cure Activator for Neoprene Latex Compounds." BL-359. By R. O. Becker. 8 pages. This report indicates that five parts of Saran Latex F122-A15, a product of Dow Chemical Co., markedly increases the cure rate of neoprene latex compounds at 284° F. Amounts in excess of five parts have little additional effect. Saran increases the modulus and lowers the oil swell of latex films, but does not impair neoprene's good heat resistance, ozone resistance, and low-temperature properties. Tables and plots demonstrating these results are included.

"Linseed Oil as a Non-Staining Antiozonant for Neoprene." BL-364. By R. M. Murray. 3 pages. Light-colored, non-staining neoprene compounds with exceptional ozone resistance may be obtained by using raw linseed oil as a plasticizer. Such compounds are also scorch resistant, have a low brittle temperature, and retain ozone resistance after heat aging.

"Cold-Sprayed 'Hypalon' Coatings for Porous Surfaces." BL-363. By I. D. Roche. 7 pages. New coating system makes it possible to cold-spray a continuous film of "Hypalon" synthetic rubber over porous substrates such as cut urethane foam, elastomer foam and curled animal hair. Formulations, application data, and solvent information are included in this report.

"Chemical Loaded Molecular Sieves in Rubber and Plastics." Linde Co., division of Union Carbide Corp., New York, N. Y. 12 pages. This brochure discusses the general properties of Linde molecular sieves, with emphasis on their uses in latent curing and such factors as release temperatures *versus* volatility. One section covers testing the sieves for determining performance. Methods of handling the sieves are described. The final portion of the brochure lists types of chemicals presently available in the sieves.

"Morningstar-Paisley Has Already Touched Your Life Several Times Today." Morningstar-Paisley, Inc., New York, N. Y. 8 pages. This booklet should be of interest to those in fields in which starches, dextrines, processed water-soluble gums, adhesives, and other specialty chemicals are used. It lists the industries and manufactured goods where the company's products are used, gives the origin of the raw materials, and offers concise descriptions of these products.

"Monomast Upright." Hyster Co., Danville, Ill. 4 pages. Good forward visibility for the lift-truck operator is afforded by Hyster's exclusive Monomast Upright, described in this brochure. The Monomast upright is available on Hyster Challenger pneumatic-tire lift trucks from 2,000 through 5,000 pounds, capacity, and on Hyster SpaceSaver cushion-tire lift trucks from 3,000 through 5,000 pounds capacity.

"General-Purpose Control Catalog." GEC-1260D. General Electric Co., Schenectady, N. Y. 72 pages.

"Iron Fireman—Automatic Firing Equipment—Gas, Oil and Coal." Form 6260. Iron Fireman Mfg. Co., Cleveland, O. 12 pages.

"High Tensile Strength Butyl-Polyethylene Sponges." Sheet No. 35. 2 pages. **"Compounding Enjay Butyl for Dynamic Properties."** Sheet No. 36. 6 pages. Enjay Laboratories, Linden, N. J.

"Pliolite Latex 140." Tech-Book Facts Bulletin PLL-12. Chemical division, The Goodyear Tire & Rubber Co., Akron, O. 2 pages.

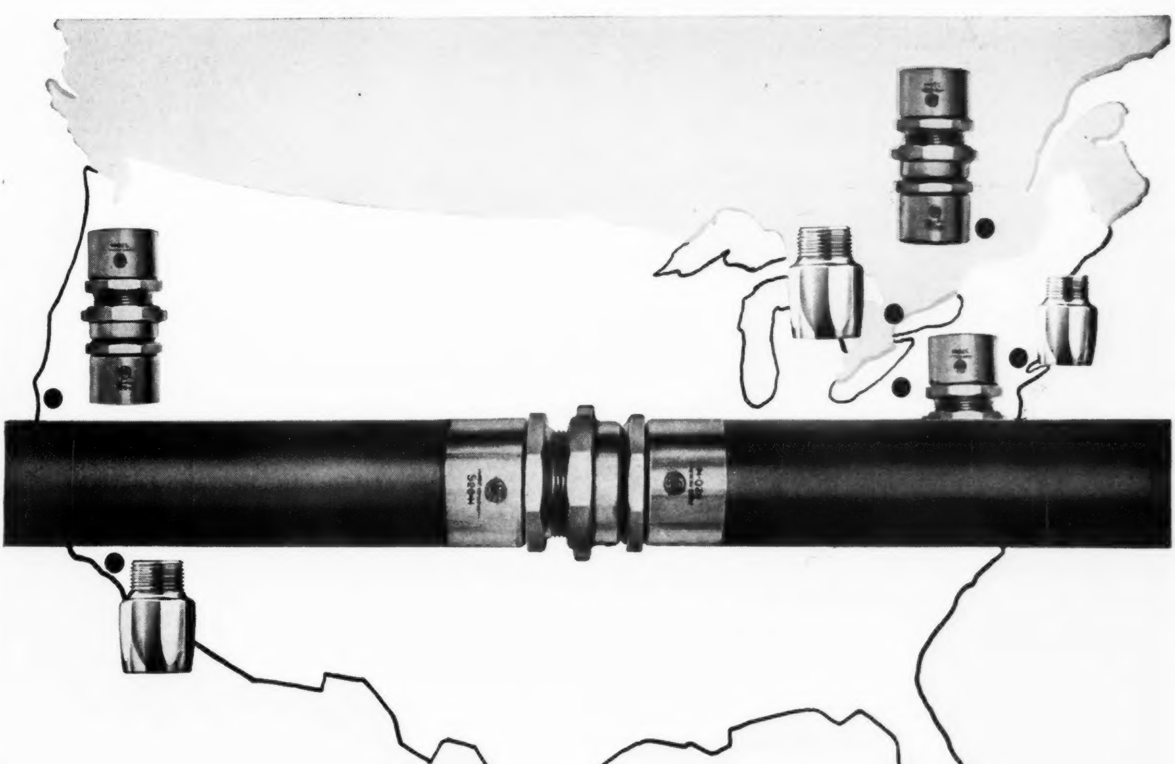
"Reilly Chemical Index—Fifth Edition." Reilly Tar & Chemical Corp., Indianapolis, Ind. 8 pages.

IMMEDIATE SERVICE

ANYWHERE in U.S. & Canada. Scovill's nationwide facilities provide the industry's fastest service on fuel oil and gas pump couplings!

Only Scovill with its country-wide network of sales offices and warehousing facilities is equipped to give you such fast . . . efficient service. All orders for fuel oil and gas pump couplings received by Scovill are shipped *promptly*. And the sizes you want are always *immediately* available. That's because Scovill makes and stocks a complete range—from 3/4" to 3" in fuel oil couplings . . . and all standard sizes in gas pump couplings.

The largest—and finest—sales and service force in the industry is ready to consult with you anytime, anywhere when you specify Scovill couplings. And—because you can buy *direct* from Scovill—you save up to 1/3 the former cost of oil and gas pump couplings. Get complete details now. Write: Scovill Manufacturing Company, Hose Coupling Department, Waterbury 20, Connecticut.



Hose couplings by **SCOVILL**

Main office: 99 Mill Street, Waterbury, Connecticut **Cleveland:** 4635 W. 160th Street **Los Angeles:** 6464 E. Flotilla Street **Houston:** 2323 University Blvd. **San Francisco:** 434 Brannan Street **Toronto:** 334 King Street, East

NEW MATERIALS

RTV-992, -993, -994 Curing Agents

The preparation of RTV (room temperature vulcanizing) silicone rubber is now improved and simplified with the introduction of three new paste-type curing agents by the silicone products department, General Electric Co., Waterford, N. Y. RTV silicone rubber compounds are cured at room temperature by the addition of metal soap curing agents which are usually in liquid form. The liquid curing agents now have been diluted by incorporating them into colored, silicone-base paste formulations, RTV-992, RTV-993, and RTV-994.

Because the paste curing agents contain only a small percentage of the liquid curing agent, a larger volume of paste curing agent is necessary to give equivalent cure characteristics. This larger amount of paste curing agent can be measured faster and with greater accuracy by plant personnel and will insure greater uniformity in automatic metering-mixing-dispensing machines, reports the producer. The contrasting color of the paste, moreover, assures thorough mixing in hand-operations.

Some preliminary physical property data on the new pastes follow:

Paste Curing Agent	Color	Specific Gravity	Liquid Curing Agent Equivalent @ 10% by Weight of Paste Agent
RTV-992	orange-tan	1.84	0.1% Thermolite-12*
993	black	1.55	1.0% Silicure L-24†
994	off-white	1.94	1.0% Thermolite-12

* Metal & Thermit Corp., Rahway, N. J.
† Nuodex Products Co., New York, N. Y.

The three available types of paste curing agents offer the user a broad range of curing conditions to meet specific application requirements. Depending upon the percentage of curing agent used and particular RTV compound required, pot life and tack-free-time can be controlled from 15 and 30 minutes respectively, to several days.

Additional information and a preliminary technical data sheet on these three new paste curing agents are available from the company.

Dow Corning 199

Dow Corning 199 (formerly Dow Corning QF-1-0099) is a silicone-glycol copolymer, developed by Dow Corning Corp., Midland, Mich., for use as a cell-control additive in "one-shot" polyurethane foams. Developed specifically for "one-shot" formulations, the additive is said to be effective at lower concentrations, to produce a lighter foam at equivalent concentrations than previous silicone additives, and to produce a tack-free surface sooner than with other additives.

Dow Corning 199 has proved effective also as an additive for rigid polyurethane foams. It promotes the formation of small, uniform cells. In rigid foams, it produces a high percentage of closed cells. This effect is the reverse of its behavior in "one-shot" flexible foams, where the additive gives a high concentration of open cells.

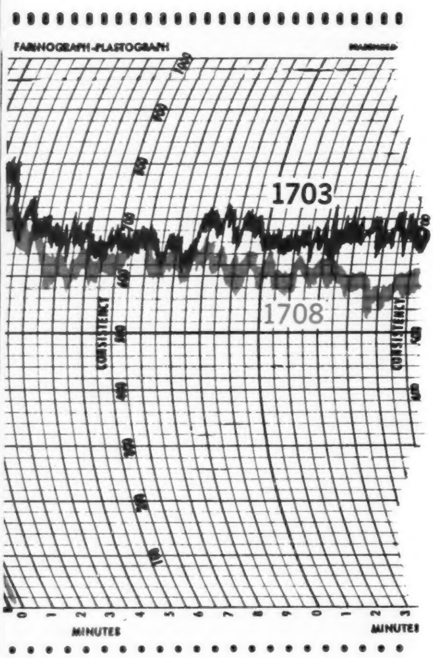
Dow Corning 199 is soluble in polyglycols, toluene diisocyanate, and amines, but it is not readily miscible with water. It was designed for addition to the non-water-bearing ingredients because silicone additives for "one-shot" foams are inherently more stable in non-aqueous reactants.

(Continued on page 616)

Look alike, used for similar products. But Ameripol 1708 costs 7% less than low-oil 1703.

Can you make this 7% COST REDUCTION?

If you are now using a low-oil SBR for molded and extruded goods you can cut costs by switching to Ameripol 1708 ($37^1/_2$ part oil). Tests show physical properties compare favorably, color excellent, processability improved.



HIGHER-OIL
AMERIPOL
1708
EASIER TO PROCESS
Plastograph Comparison

One of the most widely used oil-extended SBR rubbers is 1703. Thus this polymer was selected as a "control" in laboratory tests to determine the advisability of switching to lower-cost Ameripol 1708, a higher-oil-level counterpart of 1703, in typical compounds. Comparative tests show that you can switch to Ameripol 1708 and obtain much the same physicals (improved in some respects). The tests were made in Goodrich-Gulf's Sales Service Laboratory on a typical low cost mat compound. The data here may help guide you to a substantial cost reduction. Ask your Goodrich-Gulf sales representative for complete information.

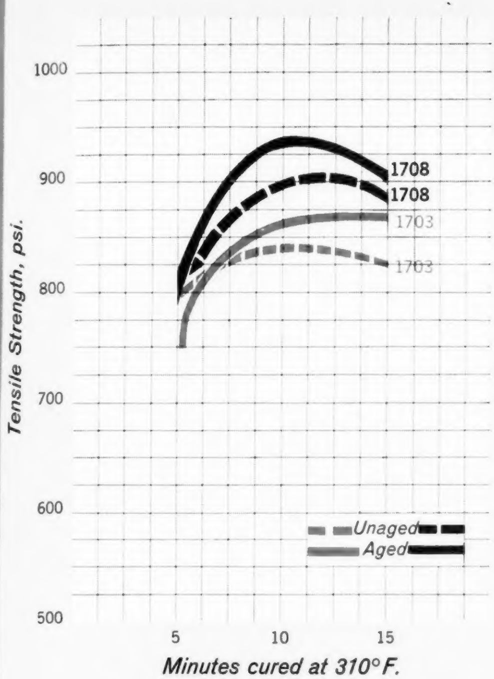
RECIPES USED FOR COMPARISON OF 1708 AND 1703

The two polymers 1703 and 1708 were substituted for each other, part for part, in the typical low cost mat recipe given below. All other ingredients were held constant.

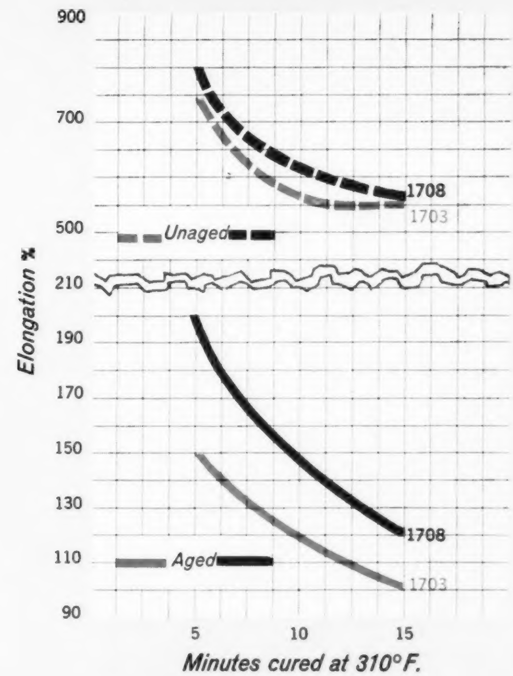
The compounded stocks were tested for Mooney scorch at 280°F and the cured compounds (5, 10 and 15 min. at 310°F for tensile, elongation, 100% and 200% modulus and hardness.

	1703	1708
Polymer	100	100
Zinc Oxide	5	5
Stearic Acid	1	1
Sunproof Wax	2	2
Cumar MH 2½	10	10
Circolite Oil	10	10
Clay	150	150
Whiting	150	150
Titanium Dioxide	5	5
Benzothiazyldisulfide	2	2
DPG	1	1
Sulfur	4	4
	440	440

Ameripol
THE PREFERRED RUBBER



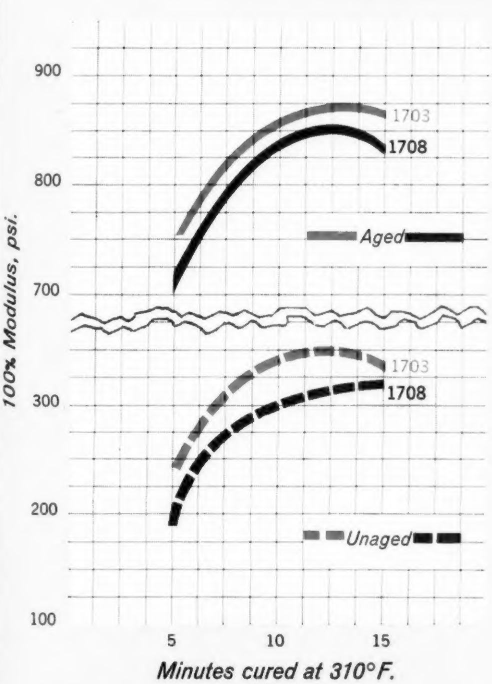
TENSILE STRENGTH



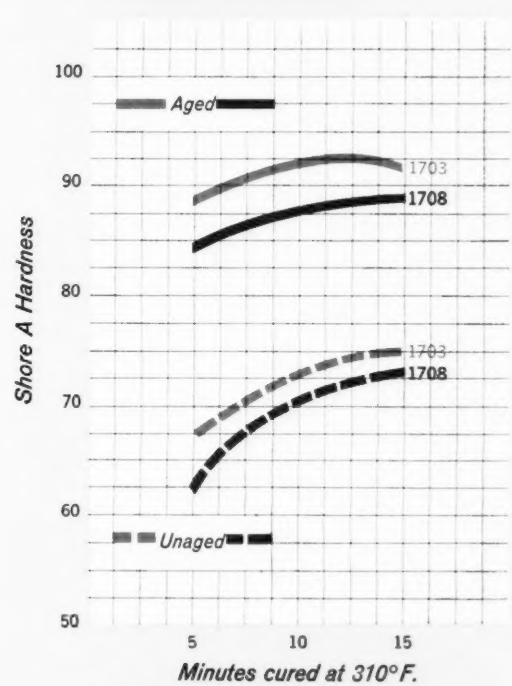
ELONGATION

Comparative tests prove performance of AMERIPOL 1708

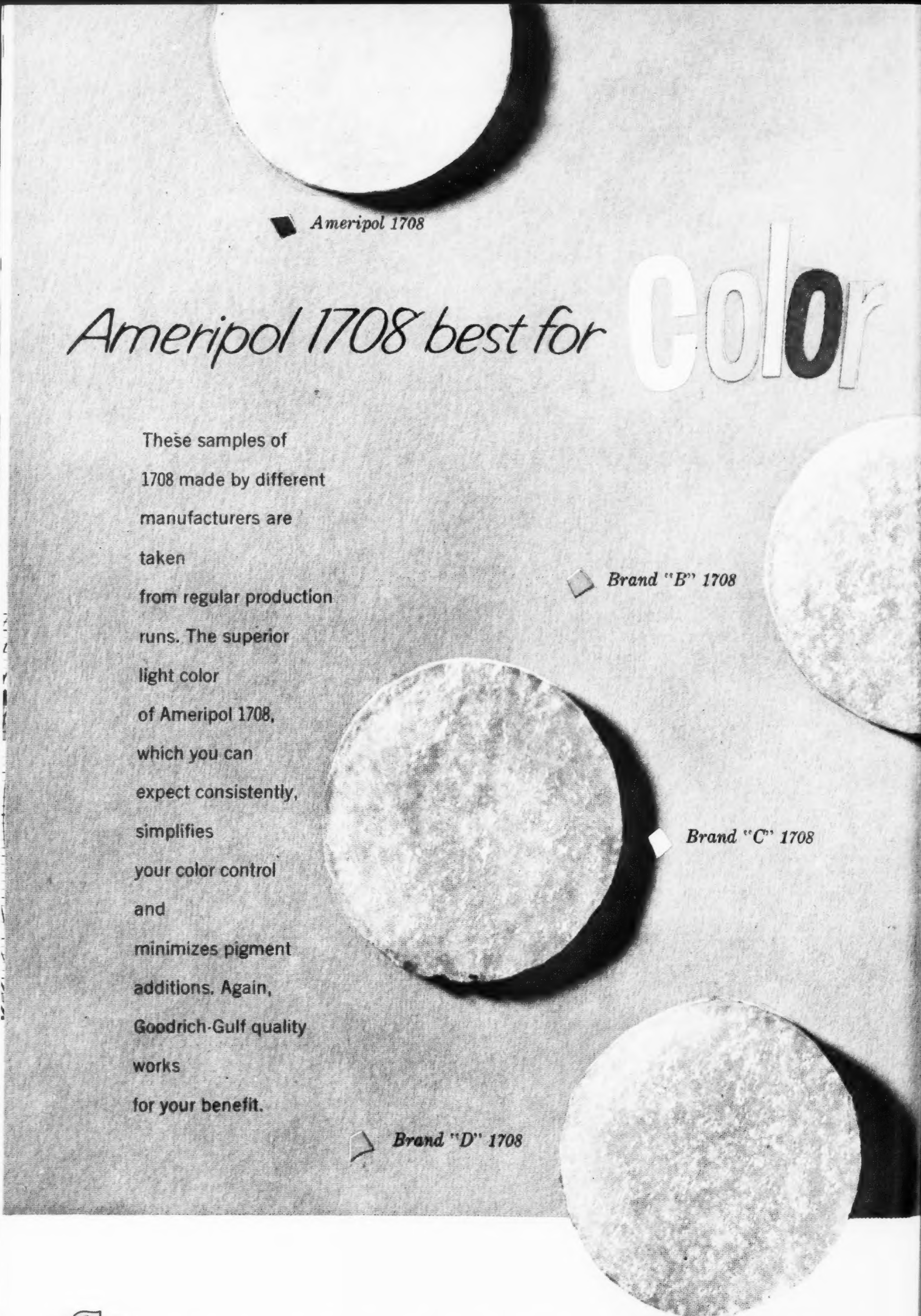
MODULUS



HARDNESS

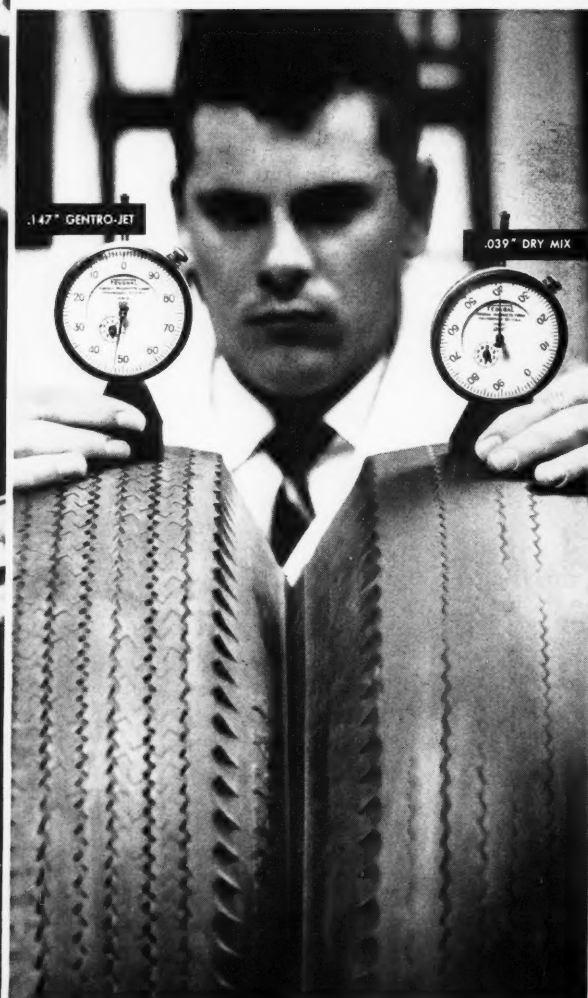


Goodrich-Gulf Chemicals, Inc.

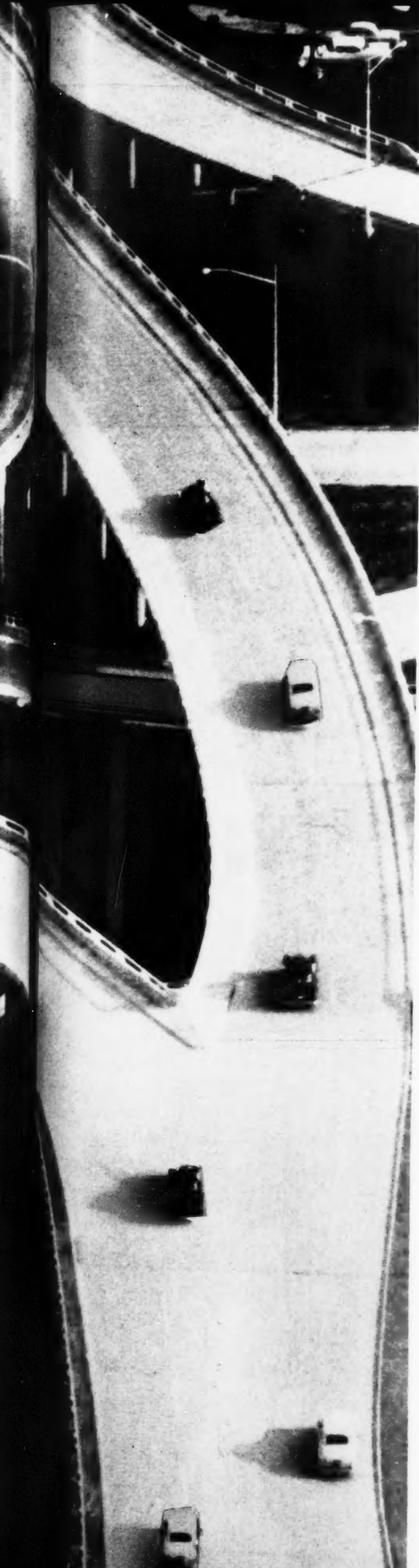


GG Goodrich-Gulf Chemicals, Inc.

1717 East Ninth Street • Cleveland 14, Ohio



On our test fleet and under actual driving conditions Gentro-Jet proved its superior durability every time. Here gauges show 31% greater tread life in the tire made with Gentro-Jet 9152 SAF black masterbatch.



(*Continued from page 608*)

Some typical physical properties of Dow Corning 199 are reported as follows:

Viscosity, centistokes, at 25° C.	5,500
Refractive index	1.4435
Flash point, °F.	350
Specific gravity at 25° F.	1.02
Color	straw

A technical data sheet, 3-114, giving more detailed information on Dow Corning 199 is available from the company.

Silastic RTV 731 Silicone Rubber

Silastic RTV 731, a new room-temperature vulcanizing silicone rubber, is now available from Dow Corning Corp., Midland, Mich. This single-component material is supplied ready-to-use in collapsible tubes. Once applied, it reacts with moisture in the air and immediately begins curing to rubber. No addition of catalyst or heat is required to initiate vulcanization. The material is said to have excellent adhesion to most clean surfaces, including metals, glass, silicone or organic resins, and silicone rubber.

The material becomes tack-free within an hour after exposure to air. In 24 hours it is completely cured to a tough, rubbery solid. Resiliency is retained over temperatures ranging from —70 to 300° F. continuous service or as high as 500° F. for shorter periods of time. Silastic RTV 731 is said to be highly resistant to oxidation and moisture and to defy the effects of weather and ozone.

Some typical properties of this new Silastic are reported as follows:

Color	white
Specific gravity @ 77° F.	1.15
Rate of extrusion, ⅛" orifice, 90 psi. air pressure, gm/min.	60
Flow (sag or slump), in.	nil
Brookfield viscosity, centipoises	approx. 700,000
Tack free time, hours	less than 1
Cure time, hours	24
Brittle point, °F.	−100
Durometer hardness, Shore A	25
Tensile strength, psi.	200
Elongation, %	250

A technical data bulletin, 9-406, and additional information on this new material are available from its manufacturer.

Ozono—Antiozonant-Suncheck Agent

A new antiozonant, antioxidant, anti-suncheck agent to protect rubber goods against weather and flex cracking has been announced by Beacon Chemical Industries, Inc., Cambridge, Mass. Described as a synergistic blend of antiozonants, antioxidants, and anti-suncheck agents, Ozono is specially formulated to insure a good dispersion of itself within the compound to produce maximum efficiency.

Ozono is said to afford better ozone cracking protection than mixtures of commercial antiozonants and waxes used separately. Ozono is further said to be more economical than commercial materials normally used. It is manufactured in pellet form, which makes its incorporation into rubber stock simple in an internal mixer or on a mill.

Ozono is recommended for tire carcass, inner tubes, footwear, molded heels or soles, sundries, sponge, automotive rubber, wire insulation, and tubing. A concentration of 3-5 parts phr. provides excellent dynamic and static ozone resistance, it is claimed.

(*Continued on page 650*)

CALENDAR of COMING EVENTS

February 15
Detroit Rubber & Plastics Group, Inc. Detroit Leland Hotel, Detroit, Mich.

February 19
Connecticut Rubber Group. Symposium: "Polymers for the '60's." Waverly Inn, Cheshire, Conn.

February 26
Quebec Rubber & Plastics Group. Ladies Night Dance. Victoria Hall, Montreal, P.Q., Canada.

March 1
The Los Angeles Rubber Group, Inc. Biltmore Hotel, Los Angeles, Calif.

March 10
Northern California Rubber Group.

March 11
Chicago Rubber Group. Furniture Club, Chicago, Ill.

March 17
Quebec Rubber & Plastics Group. Queens Hotel, Montreal, P.Q., Canada.

March 18
Boston Rubber Group. Hotel Somerset, Boston, Mass.

March 21-23
American Physical Society, Detroit, Mich.

March 22-24
Division of High-Polymer Physics, APS. Detroit, Mich.

April 5
The Los Angeles Rubber Group, Inc. Biltmore Hotel, Los Angeles, Calif.

April 7
Rhode Island Rubber Club. Pawtucket Country Club.

April 8
Rubber Division, CIC. Annual Meeting. Walper House, Kitchener, Ont., Canada.
Akron Rubber Group. Sheraton Hotel, Akron, O.

April 14
Fort Wayne Rubber & Plastics Group. Van Orman Hotel, Fort Wayne, Ind.
Northern California Rubber Group.

April 20
Quebec Rubber & Plastics Group and Montreal Section CIC. Joint Meeting on "Industrial Development." Queens Hotel, Montreal, P.Q., Canada.

April 22
Detroit Rubber & Plastics Group, Inc. Detroit Leland Hotel, Detroit, Mich.
Chicago Rubber Group. Furniture Club, Chicago, Ill.

April 29
Philadelphia Rubber Group. Poor Richard Club, Philadelphia, Pa.

May 3-6 (*Note corrected dates*)
Division of Rubber Chemistry, ACS. Statler Hotel, Buffalo, N. Y.

May 20
Connecticut Rubber Group.

May 23-26
Design Engineering Show. Coliseum, New York, N. Y.

June 3
Quebec Rubber & Plastics Group. Golf Tournament. St. Hyacinthe, P.Q., Canada.

June 10-11
Southern Rubber Group. Birmingham, Ala.

June 24
Detroit Rubber & Plastics Group, Inc. Outing. Western Country Club.

Gives high whiteness—with minimum loading

UNITANE® 0-220

TITANIUM DIOXIDE

Save – through minimum loading – with UNITANE 0-220, yet get maximum whiteness in the bargain! The high opacity and clear color tone of this pigment give it maximum whitening power; you load less, get better results!

UNITANE 0-220 also eliminates some of the trouble spots in processing. It wets easily, is readily dispersible and is non-reactive with rubber chemicals. UNITANE 0-220 maintains its brilliancy throughout curing and aging, assuring a better-looking finished product with longer-lasting whiteness.

For economy, easier processing and product improvement, specify UNITANE 0-220. Just ask your Cyanamid Pigments representative for samples and full information.

CYANAMID

AMERICAN CYANAMID COMPANY
Pigments Division
30 Rockefeller Plaza, New York 20, N.Y.
Branch Offices and Warehouses in Principal Cities

NEW PRODUCTS

New FAB P-5 Label

An unusual pressure-sensitive fabric label developed by the Avery Label Co., Monrovia, Calif., is providing distinctive product identification on hard-to-label surfaces.

Featuring a durable rayon-acetate material, the new permanent-gripping FAB P-5 Label is extremely flexible and has remarkable formability for use on sharply curved surfaces such as rubber or plastic hose, metal or glass tubes, bottlenecks, and even on spherical objects. Dispensed rapidly by Avery's electrical or manual equipment, these labels bond to rough, curved, or wrinkled surfaces.

Although the new label will not withstand laundering or dry cleaning, the new self-adhesive label will cling to a variety of fabrics such as cotton, wool, and synthetics. Also, these labels print well, accept typing or rubber-stamping, and may be written upon with a ballpoint pen.

Rub-R-Vive Rubber Cleaner

An effective rubber cleaner/restorer that is easily applied to surfaces of rubber parts in typewriters, office machines, and printing equipment has been announced by Schwartz Chemical Co., Long Island City, N. Y. The new cleaner, called Rub-R-Vive, is a non-volatile, non-flammable liquid that renews the surface properties of platens, rollers, and other friction rubber parts through its surface plasticizer action on rubber.

Rub-R-Vive is applied by simple application with a cloth. Surfaces are briskly rubbed to remove stubborn adhesion of ink and dirt, followed by a wipe to provide a thin film which is absorbed to renew original feel, resilience, and grip.

Rub-R-Vive, it is further claimed, provides true plasticizer action that assures softening of rubber surfaces without drying effect, as is the case when conventional cleaning fluids are used.

Rub-R-Vive is distributed directly in pint, quart, and gallon containers, subject to discount in quantities.

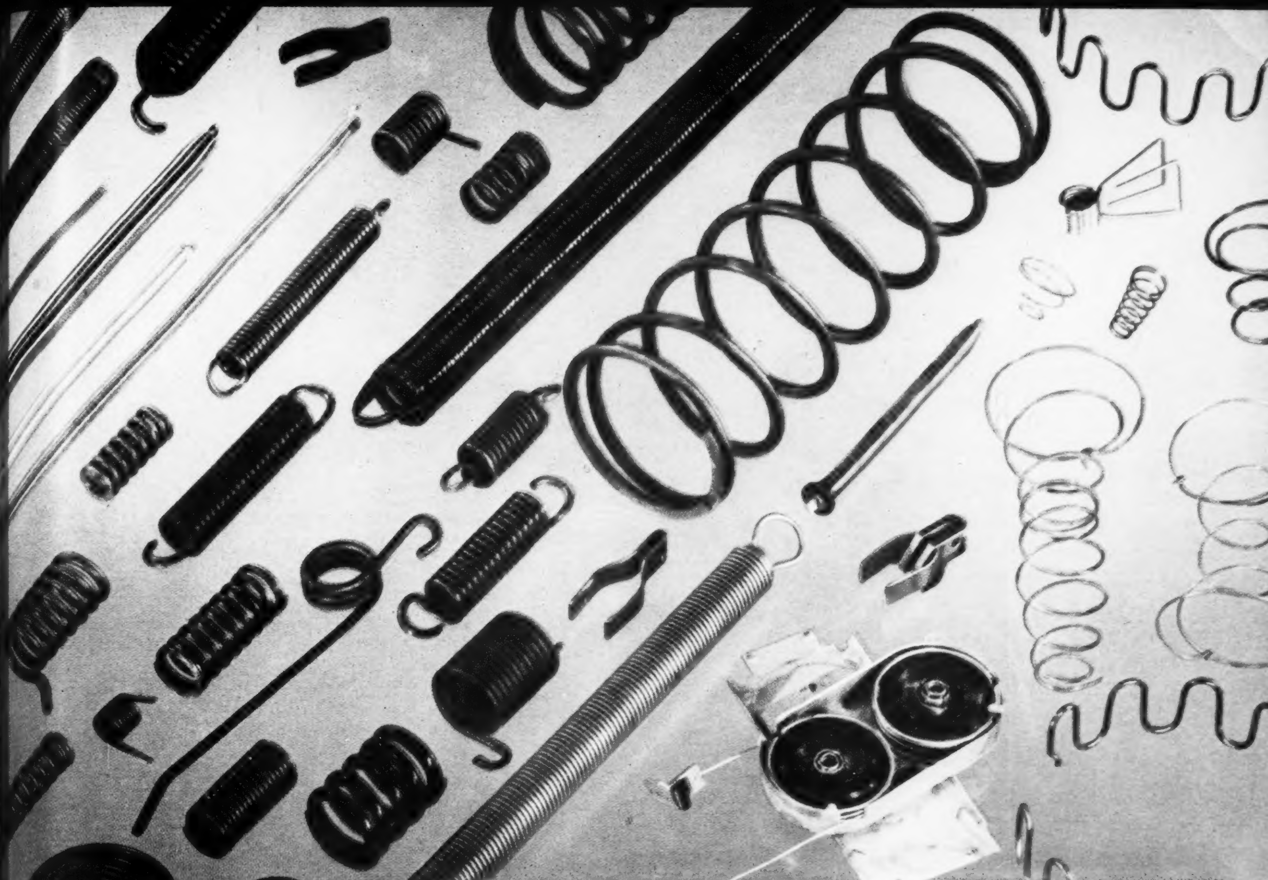
Sandvik Belts for Moving Sidewalks

New Sandvik rubber-covered steel bands for belting applications in passenger conveyors are announced in Booklet E-776, available from Sandvik Steel, Inc., Fair Lawn, N. J., manufacturer of steel belt conveyors. The firm is a subsidiary of The Sandvik Steel Works Co., Ltd., Sandviken, Sweden. For passenger conveyors, the firm makes only the belts, but has engineering help which is at the disposal of other firms who do the construction and other work.

The steel core of the bands imparts great tensile strength, stiffness, and good elasticity. The elongation is said to be slight. The rubber cover provides a soft, non-slippery surface and protects the steel against mechanical damage. These bands are of the high tension type and are used for heavy and abrasive loads in great inclines. These bands have been tested under extremely severe conditions, such as the handling of ore in mines.

Dimensions of the bands are: widths, 500-800 mm., and 1000 mm. will be available, thickness, the thickness of the steel core ranges from between 1.2 and 1.6 mm. The rubber cover varies from 4 to 8 mm. (4 mm. on the bottom, 4-8 mm.

(Continued on page 740)



...Results of a Superior Beginning

The countless parts and products made from Roebling high-carbon steel spring wire and flat spring steel have one thing in common . . . their superior quality. This, of course, is related to the inherent fineness of the materials.

The variety in which Roebling offers these spring materials is equally impressive. They are available in hard drawn, hard rolled, annealed or soft, tempered or untempered. Types include zigzag and no-sag wires; upholstery and mechanical spring wires; valve spring wire; clock- and motor-type spring steels and flat spring steels of all types and description.

Whatever the type, size or characteristics you require—Roebling can fit your needs exactly. You'll find that Roebling quality means maximum production from your machines and consistent uniformity in your product.

For spring wire and flat spring steel information, contact Roebling's, Wire and Cold Rolled Steel Products Division, Trenton 2, New Jersey.

ROEBLING

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John A. Roebling's Sons Division • The Colorado Fuel and Iron Corporation

Roebling... Your Product is Better for it

SYNPOL® FITS!

WHICH SYNPOL FITS YOUR NEED?		
HOT-TYPE POLYMERS	1006 1061 1009	These original SBRs give easy processability, are exceptionally light colored.
COLD TYPE	1502 1551	For manufacturers who require the special properties and quality offered by cold-type polymers.
COLD OIL-EXTENDED POLYMERS	1703† 1707* 1708* 8200* 8201**	Offers the superior properties of cold polymers at substantial economy.

Varying degrees of oil extension—†25 parts, *37.5 parts, **50 parts

TEXUS

TEXAS-U.S. CHEMICAL COMPANY

260 Madison Avenue, New York 16, N. Y. · MUrray Hill 9-3322

Left hand selector knob regulates duration of condensate valve opening. Adjustable from 2 to 13 seconds. Right hand knob controls a time cycle interval—1 minute, 2 minutes, or continuous. Power switch is located at upper left.

• SIMPLE DESIGN

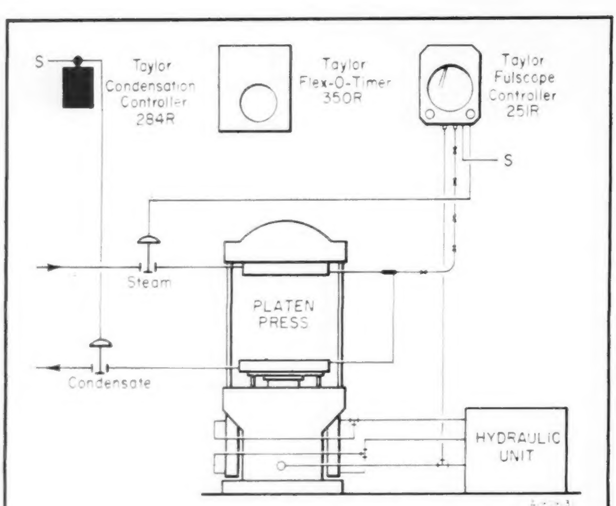
• EASY TO ADJUST

• MAINTENANCE FREE

The new 284RJ Blow-Down Timer is a single function repeating cycle timer. It is designed to regulate a pneumatic control valve or other air operated device for two to thirteen seconds, once every one or two minutes. The pneumatic device may also be operated continuously.

This versatile instrument can be adapted to many applications, including removal of condensate from press platens and the operation of continuous boiler blow-down systems.

Announcing the NEW Taylor BLOW-DOWN TIMER!



A typical application for the new Blow-Down Timer—maintaining uniform temperature on a Platen Press by periodic purging.

Mounted in a J.I.C. approved gasketed dirt tight case, it has a large capacity (3/16" orifice) solenoid valve capable of 90 psi operation, rigidly mounted outside the case; electrical connections are gasketed. Power supply cable enters the case through a compression grommet.

Timing is accomplished by motor driven rotary wiper arms which contact commutator bars to energize a 6-volt circuit. A relay actuates the solenoid air valve which admits air to the control valve.

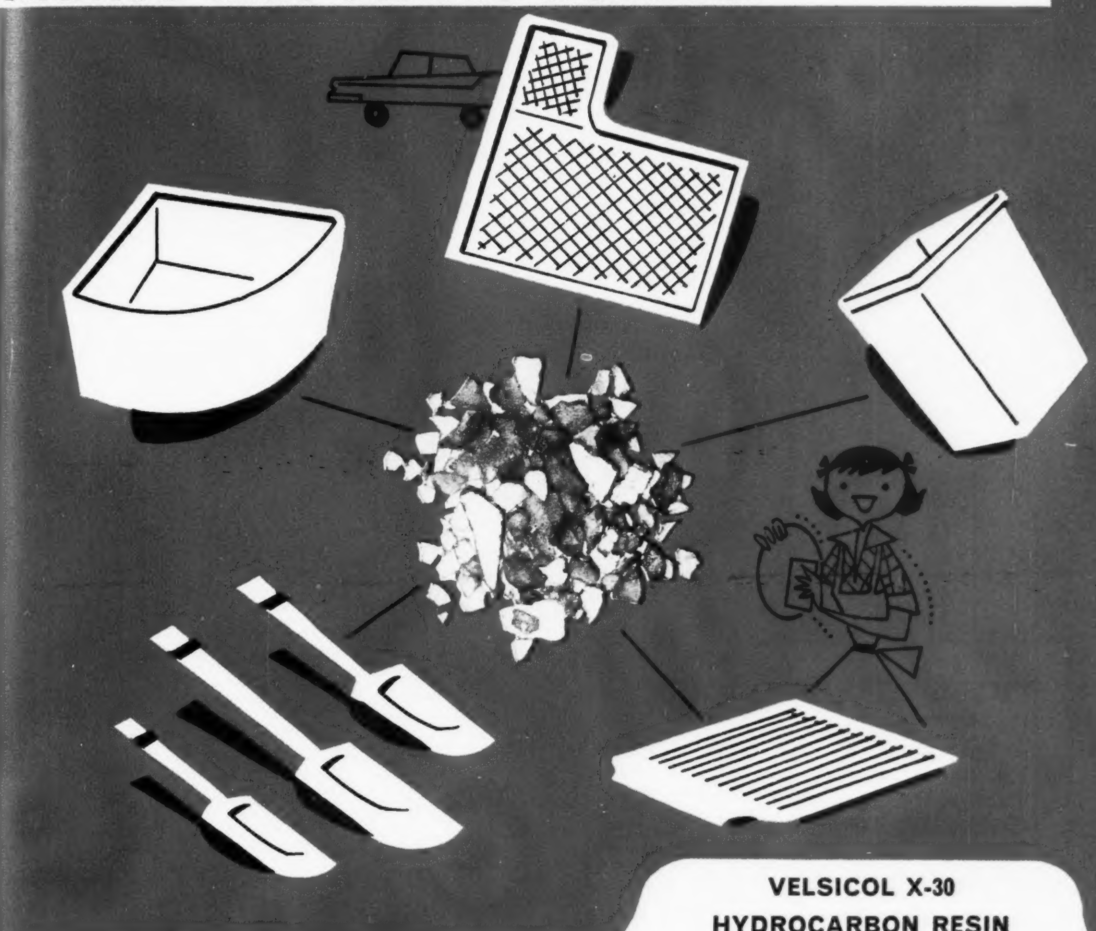
All basic component parts such as the timing motor, solenoid valve, transformer, relay, etc., can be removed through plug-in socket arrangements or tapered pin plug-in terminal connections. Commutator circuits are kept clean by the continuous wiping action of the rotary contact arms. For additional insurance the commutator circuits are enclosed in plastic.

For more information call your Taylor Field Engineer, or write for Sales **Bulletin No. 98351.** Taylor Instrument Companies, Rochester, N. Y.; Toronto, Ont.

Taylor Instruments MEAN ACCURACY FIRST

VELSICOL X-30 HYDROCARBON RESIN

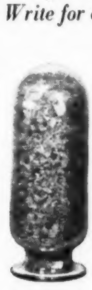
makes mat stocks behave!



VELSICOL X-30
HYDROCARBON RESIN

Mat stocks and other stocks with high clay loadings can be made pliable and easy to process by adding Velsicol X-30 hydrocarbon resin to the recipe. X-30 enables you to use the highest clay loadings without sacrificing tensile strength, elongation, or processing characteristics. You'll get better milling, calendering, and tubing. Cures will be more uniform, and stocks non-scortchy. Toughness, hardness, and resistance to aging and abrasion will be improved. Raw materials costs will be lower, too. Write for complete information about Velsicol X-30 resin today!

PHYSICAL PROPERTIES, VELSICOL X-30 RESIN



Type: Thermoplastic Hydrocarbon
Form: Flaked
Softening point (ball and ring): 210°—220°F.
Color (coal tar scale): 1½—2
Color (Gardner): 10-11
Color (Rosin scale): I—K
Acid No.: 0-2
Saponification No.: 0-2
Compatible with a variety of natural and synthetic rubber compounds. Has good electrical insulation properties, because it is a hydrocarbon polymer.

VELSICOL

LOOK FOR THIS MAN
. . . your Velsicol representative, a qualified chemist who can help you make better products for less!

MAIL COUPON TODAY FOR MORE INFORMATION!

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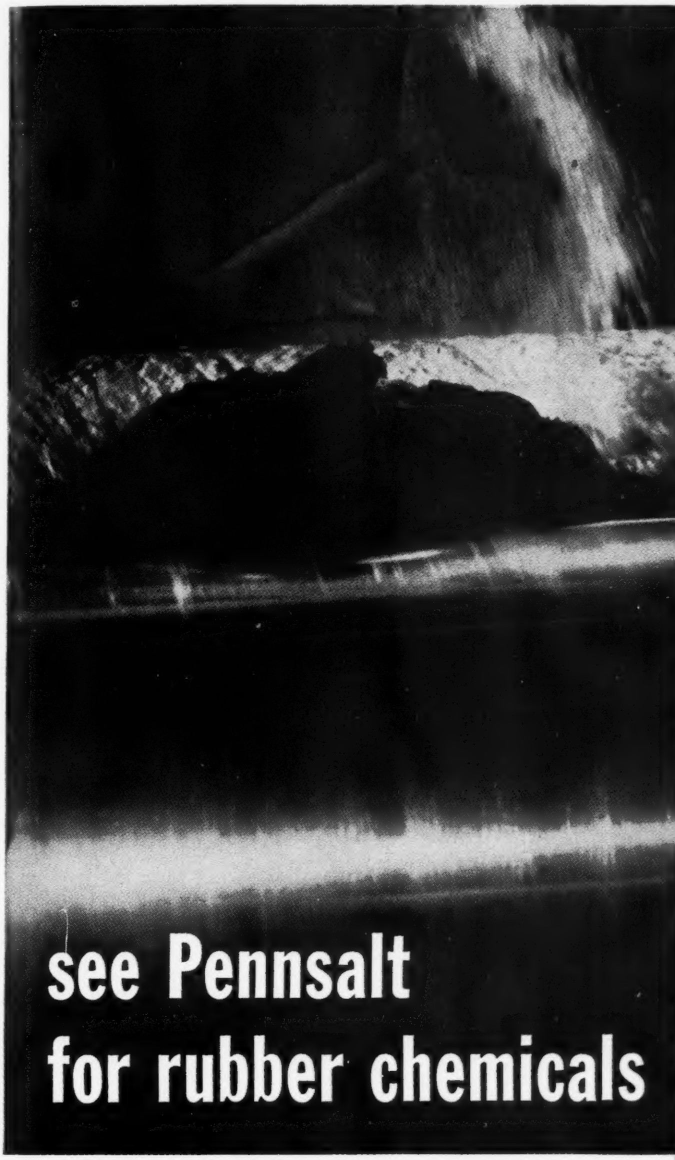
330 East Grand Ave., Chicago 11, Ill.
International Representative: Velsicol International Corporation, C.A. P.O. Box 1687 • Nassau, Bahamas, B.W.I.

Gentlemen: I am interested in more information about your X-30 resin.
☐ Please send literature
☐ Please send test sample RW-20
☐ Please have salesman call

Name__________
Company__________
Address__________
City______ Zone______ State______



ACCELERATORS AND VULCANIZING AGENTS

METHYL THIRAM, ETHYL THIRAM—Versatile primary accelerators, activators, vulcanizing agents for Hevea, SBR, nitrile, butyl rubber. Retarders for Neoprene GN.

METHYL ZIRAM, ETHYL ZIRAM, BUTYL ZIRAM—Active ultra accelerators and activators for Hevea, SBR and nitrile, especially for latex and wire compounds.

ETHYL SELERAM—Extremely active ultra accelerator for continuous vulcanization wire compounds and butyl rubber.

ETHYLAC®—Primary accelerator for Hevea, SBR and nitrile compounds. Provides good scorch time and rapid vulcanization. Excellent delayed action activator for thiazoles and sulfenamides, in both Hevea and SBR compounds.

DIPAC®—Sulfenamide-type primary accelerator for natural and SBR rubber. Exceptionally long delayed action followed by rapid vulcanization.

VULTAC®—Vulcanizing agents and resinous-type plasticizers for a variety of Hevea, SBR, nitrile and Hevea-SBR blend compounds.

ANTIOXIDANTS

PENNOX® A—Alkylated diphenylamine general purpose antioxidant for dry rubber and latex.

PENNOX® B, C, D—Nonstaining, nondiscoloring hindered bisphenol antioxidants for Hevea and SBR vulcanizates and raw SBR polymer.

For compounding data and more detailed descriptions, write for a copy of our 40-page Rubber Chemicals Catalog, S-156.
Industrial Chemicals Division,
PENNSALT CHEMICALS CORPORATION,
3 Penn Center, Philadelphia 2, Pa.

See our complete listing in Chemical Materials Catalog

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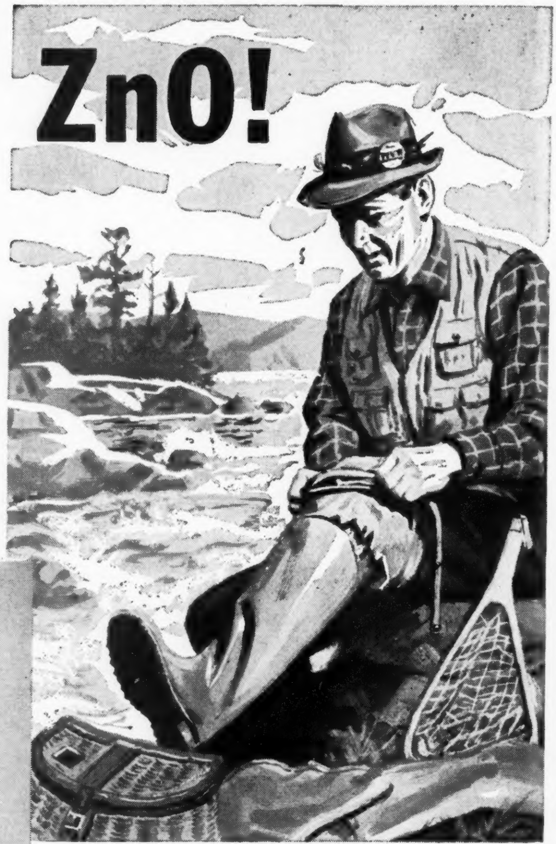
® Pennsalt Chemicals
ESTABLISHED 1850

Watch Out For "EXPENSIVE BARGAINS" in ZnO!



Are You Tying Your Reputation For Product Quality to The Price Of Zinc?

Fluctuating zinc prices mean users of secondary ZnO can "enjoy" marginal savings over primary ZnO. But on this margin — about 5¢ per 100 pounds of finished compound — rests *your reputation as a manufacturer of a quality rubber product.*

WHY RISK YOUR REPUTATION FOR PENNIES?

Here, for example, is an "expensive bargain." Our laboratories analyzed two different lots of secondary ZnO from the same supplier and found:

1. **LEAD VARIATION .04 to .11**
2. **SULPHUR VARIATION .15 to .32**
3. **BOTH HAD PRESENT AN APPRECIABLE QUANTITY OF GRITTY PARTICLES**

These results are typical. For a minute saving, the secondary ZnO user risks UNPREDICTABLE CURING RATES, DISCOLORATION IN LIGHT-COLORED RUBBER PRODUCTS and STRUCTURAL FAILURE IN THIN-WALLED RUBBER PRODUCTS.

Hardly a bargain... instead 3 very good reasons for using

ST. JOE *Lead-Free* primary ZnO!

St. Joe uses the same ores to make ZnO as is used for the production of 99.99+% Special High-Grade slab zinc. This coupled with St. Joe's exclusive methods of quality control gives you primary ZnO with consistent analyses unmatched in the industry.

LEAD-FREE ST. JOE ZINC OXIDE

As A Producer of Natural and Synthetic Rubber Products,

YOU CAN SET YOUR PROCESSING, OUR OXIDE WILL NOT CHANGE

ST. JOSEPH LEAD CO.

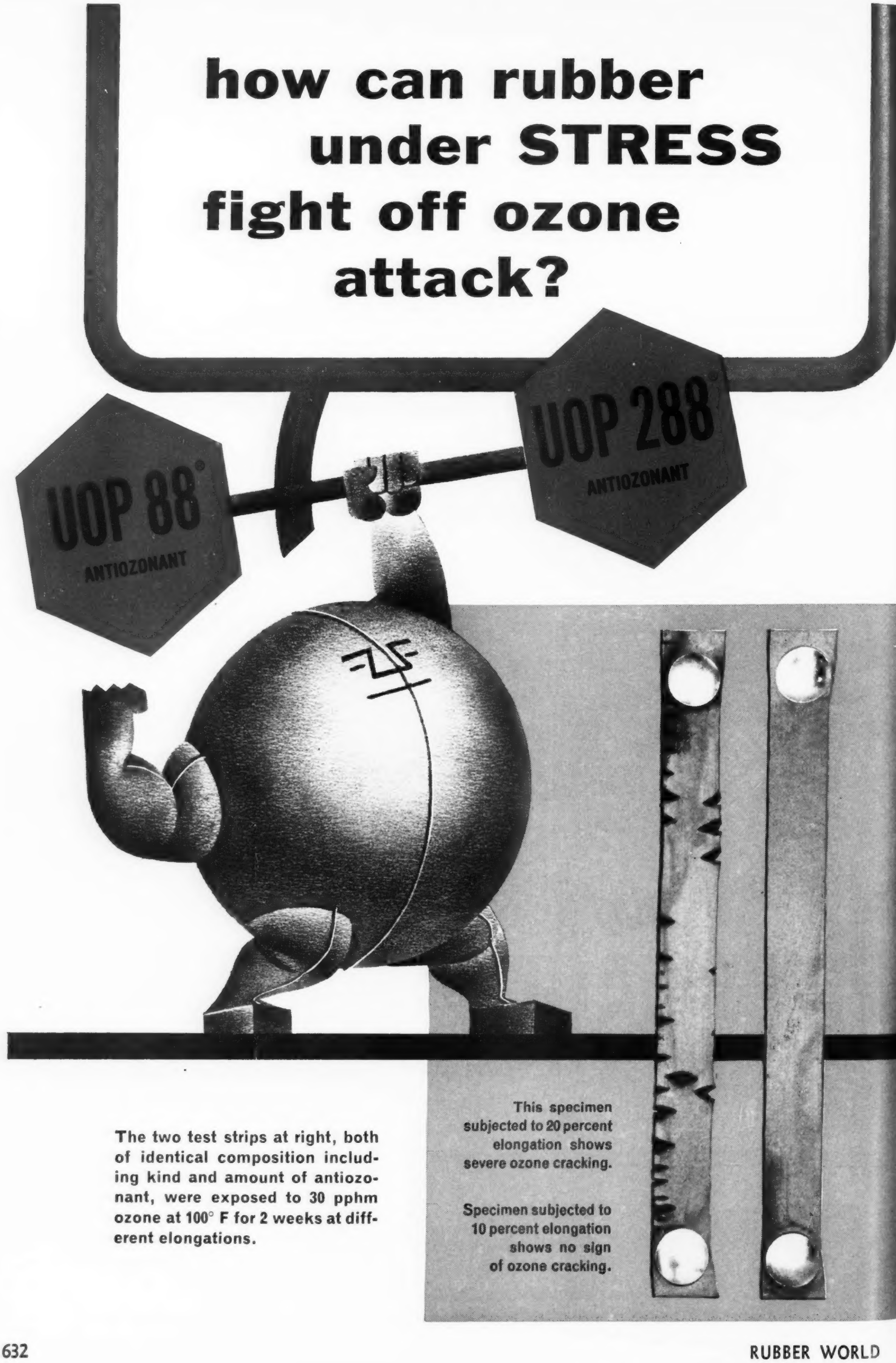
250 Park Avenue, New York 17, N. Y.

Plant & Laboratory: Monaca (Josephtown), Pa.

A Leading Producer Of Quality Zinc Oxides For Over 30 Years.

ZNO-181

how can rubber under STRESS fight off ozone attack?



The two test strips at right, both of identical composition including kind and amount of antiozonant, were exposed to 30 pphm ozone at 100° F for 2 weeks at different elongations.

This specimen subjected to 20 percent elongation shows severe ozone cracking.

Specimen subjected to 10 percent elongation shows no sign of ozone cracking.

properly formulated, rubber can withstand ozone, even under severe dynamic service . . .

What happens to a well formulated rubber compound when the vulcanized product is subjected to inherent or applied stresses?

The photos of test strips below give a graphic answer: Ozone attacks the surface of the product and severe cracks develop.

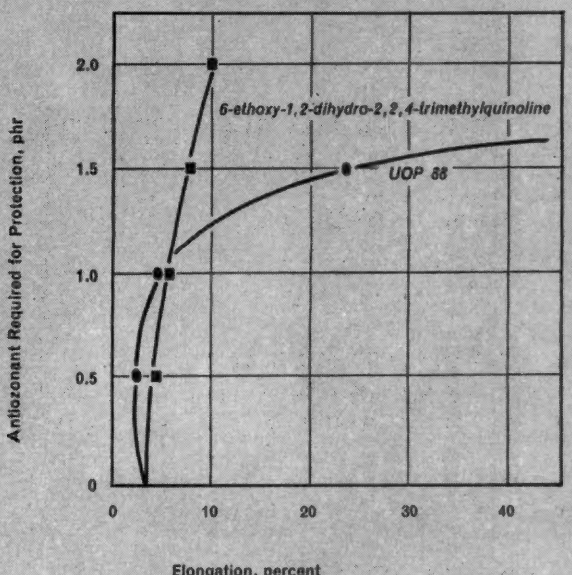
Hence the need for special ozone protection in products likely to be subjected to such service. And special protection means the kind provided by UOP 88 and 288. Unlike other protective measures, UOP antiozonants extend their protection to products under heavy physical stress and dynamic flexing. With a relatively small increase in amount, you can give your product sufficient ozone protection to withstand greatly increased stresses.

In working out rubber formulations involving the use of antiozonants avail yourself of UOP technical service and facilities. Just write or telephone our Products Department.

To cover all phases of service conditions, UOP rubber labs conduct dynamic and static tests both indoors and outdoors:

DeMattia flexer is used to evaluate flex-cracking properties of compounds tested in UOP rubber laboratory.

UOP ozone cabinets provide test conditions at a wide range of ozone concentrations.

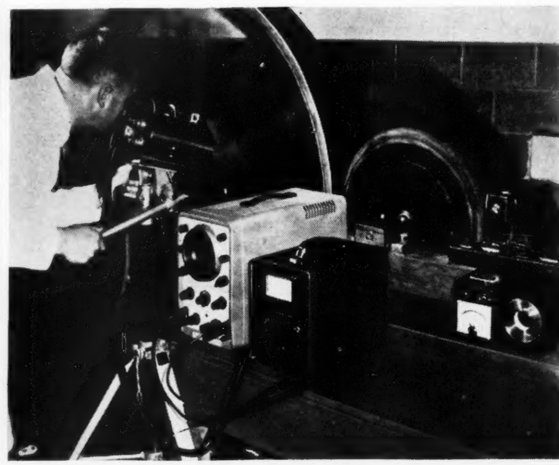


Curves plotted for UOP 88 and a competitive antiozonant show that while antiozonant requirement increases with increased strain, it does so at a far lower rate for UOP 88 than for the competitive material.

Test specimens mounted on outdoor racks are examined at regular intervals for evidence of deterioration.

UNIVERSAL OIL PRODUCTS COMPANY
30 Algonquin Road, Des Plaines, Illinois, U.S.A.

NEW EQUIPMENT



Thermodot remotely detects temperature variations to pinpoint structural defects of rotating tire

Thermodot Radiation Thermometer

The Thermodot Model TD-1 radiation thermometer, an instrument made by Radiation Electronics Co., Chicago, Ill., measures the temperature of a remote object without physical contact. Its operation is based on the fact that an object emits thermal radiation as a function of its temperature. Thermodot uses a mirror system to focus this radiation on a sensitive infrared detector which, in turn, generates a signal voltage accurately proportional to the radiation intensity. The signal is amplified and presented on a meter, an oscilloscope, or any selected output indicator. Indicated signals are converted to temperature readings by means of a standard calibration chart provided with the instrument.

The Thermodot can be used to measure and control the temperatures of moving and inaccessible surfaces. A tire manufacturer has used it to pinpoint structural defects while a tire rotates at 100 mph. Also, the device has been used to isolate voids and flaws in polyurethane insulation and in the determination of rubber-to-metal bonding and non-destructive testing of various laminates, in the latter instance, by utilizing the effect of bond on thermal conductivity.

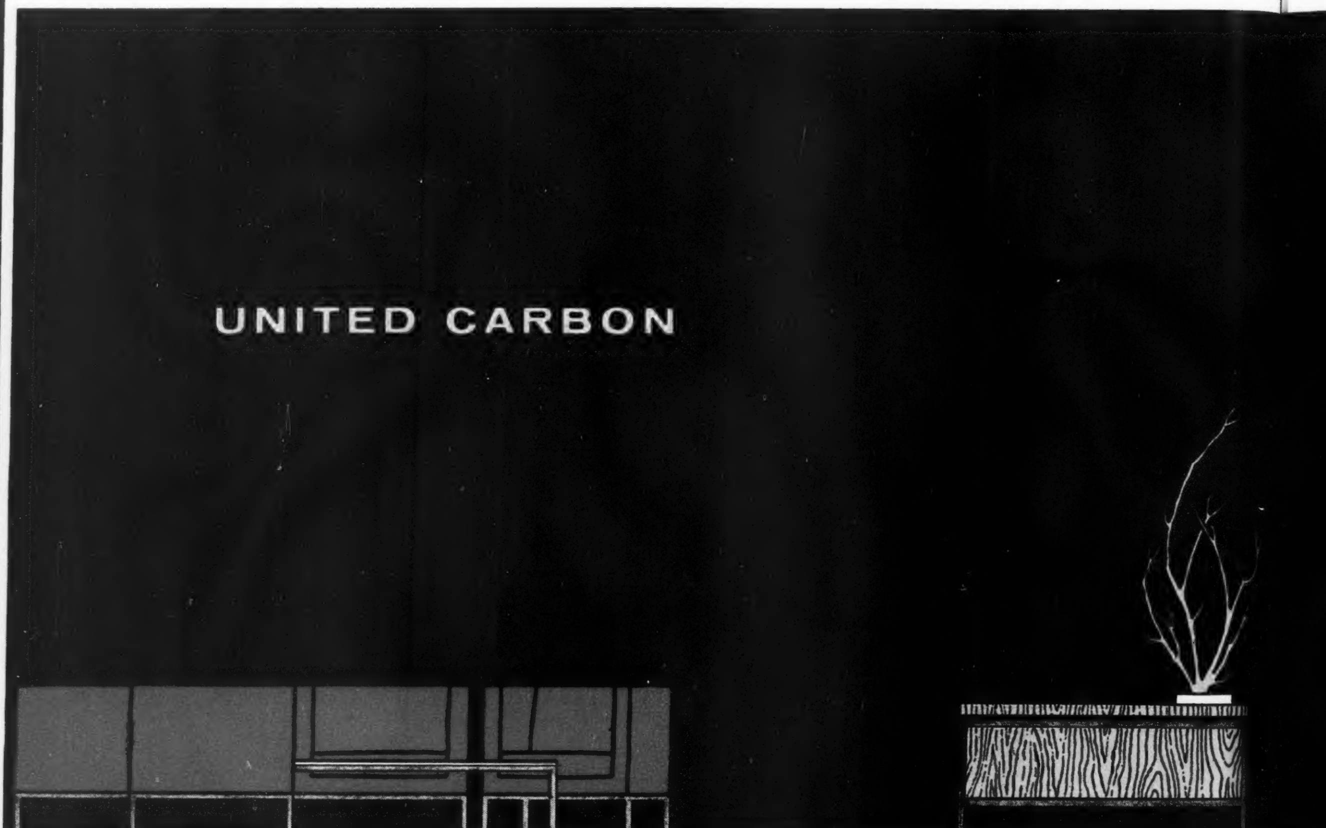
The viewed surface of the object to be tested cannot be contaminated, damaged, or influenced by the instrument, thereby permitting temperature measurements of objects which are fragile, it is also claimed. The measurements are continuous, and the instrument response is accurate and rapid. This instrument has been designed primarily for industrial testing, inspection, and quality control.

The complete Model TD-1 consists of a tripod-mounted optical head and separate control unit which may be located some distance from the optical head. The control unit weighs 28 pounds, measures 14 by 12 by 10 inches. The optical head weighs 8 pounds and measures 5.4 inches in diameter and 10 inches in length. The temperature range is 100 to 2000° F. standard, to 8000° F. with calibrated aperture. System time constant of 2, 20, or 200 milliseconds may be selected; 10 microseconds for transient response. The focusing range is from 4 feet to infinity.

More details appear in the company's bulletin No. R-101.

(Continued on page 644)

No matter what your product, process or problem involving white pigmentation, look to TITANOX® pigments and our technical service for the answer. Titanium Pigment Corporation, 111 Broadway, New York 6, N. Y.; offices and warehouses in principal cities. In Canada: Canadian Titanium Pigments Ltd., Montreal. 7539



In the past nine months there have been major personnel re-alignments and several technical facility and office relocations—all directed toward broadening United's services to its customers. Recently we had the pleasure of announcing the locations of our new home offices and our marketing headquarters. It is my privilege now to introduce our new Marketing Group and our district sales managers. We look forward to serving you with faster deliveries, finer technical service and ever improving products.

MORRISON M. BUMP
Director of Marketing

Call Hall

HALLCO NEWS

Issued by
The C. P. Hall Co.
Chemical Manufacturers

No. 9

HALLCO C-556 PLASTICIZER CUTS MIXING TIME OF NATURAL OR SYNTHETIC RUBBERS

When used in the processing of rubber, Hallco C-566 greatly reduces mixing time by speeding up dispersion of carbon black or other fillers. It also gives excellent scorch protection, often more than doubling scorch resistance time. Hallco C-566 has no measurable effect on the hardness of finished products. This economical plasticizer minimizes shrinkage in calendered stock and imparts superior smoothness to extrusions. It gives outstanding results when used for camelback, molded goods, channel stocks, cement stocks and all extruded items. Charts below show its unusual properties in our tests. Hallco C-566 is manufactured by The C. P. Hall Company and is available in drums or tank cars.

Stock Containing C-566:

	Without C-566 A	With C-566 B
Smoked Sheet	100	
Zinc Oxide	4	
Stearic Acid	0.5	
EPC Black	25	
FEF BLACK	25	
Ultex	0.75	
Sulphur	2.75	
C-566	....	7.5
	158	165.5

Mooney Scorch SR @ 250° F.

Minutes to 3-point rise	5.25	8.0
Minutes to 5-point rise	5.75	8.5
Minutes to 10-point rise	6.25	11.0

Samples and data on Hallco C-566 are available on request. Order yours today!

Be Accurate: Call it PARA-FLUX® only if it came from The C. P. Hall Company

The C. P. Hall Co.
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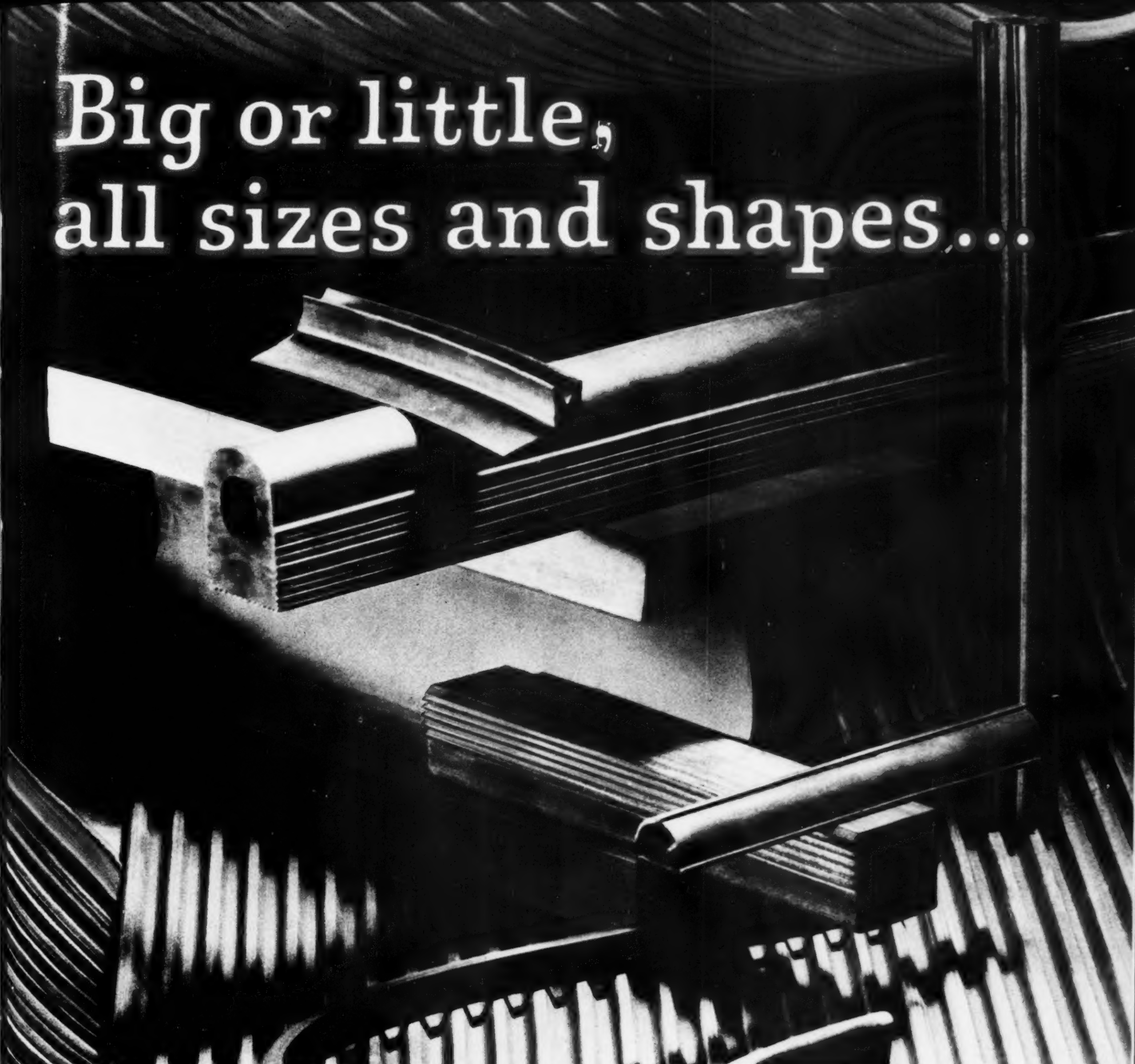

Photo shows some of the thousands of different extrusions made at Pawling Rubber Corporation, Pawling, N. Y.

You are money ahead with Philprene* rubber

FOR ALL TYPES OF EXTRUSIONS

Take Pawling Rubber Corporation, for example. This custom manufacturer makes thousands of extrusions—and they find that Philprene polymers and masterbatches provide profitable processability. Philprene rubber is of uniform high quality, assures accurate dimension of the cross section, and produces a tough, durable finished product. Philprene masterbatches give fast, smooth extrusions, reduce Banbury mixing time, eliminate black storage. Cleaner to handle, too.

Let your Phillips technical representative show you how to speed up production. He knows which Philprene polymers and masterbatches are best suited to *your* operation. There's a wide choice. You can get what you want and need when you order Philprene rubber.

*A trademark

PHILLIPS CHEMICAL COMPANY

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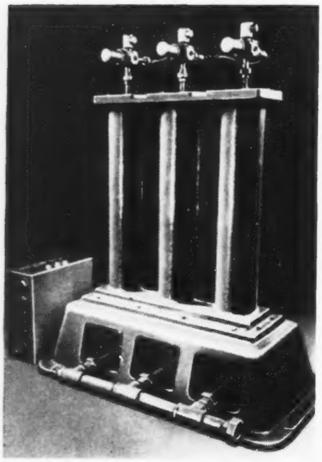
Distributors of Phillips Chemical Company Products, 80 Broadway, New York 5, N. Y.

Philprene PHILLIPS 66

New Equipment

(*Continued from page 634*)

New Crossley Free-Piston Pump



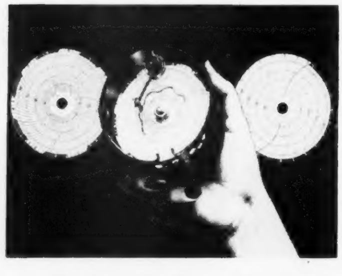
Crossley free-piston pump

A new pump, different in principle and design from others, has been introduced by Crossley Machine Co., Trenton, N. J. The new Crossley free-piston pump, with only nine moving parts, will pump any fluid material in stainless-steel non-contaminating chambers.

The pump impels a continuous air-free flow without pulsating or surging. It operates on air pressure which empties each of three gravity- or force-fed cylinders consecutively. Air charge is switched from one cylinder to the next by a timing-control system. In each chamber is a nylon free-floating piston and two nylon ball valves.

Since all contact surfaces are stainless steel, and no lubrication is required, maintenance is kept to a minimum. The pump, moreover, need not be shut down for occasional replacement of parts, since two cylinders can continue pumping while the third is being serviced. The pump can be made in any size desired.

Dry Stylus Recording Thermometer



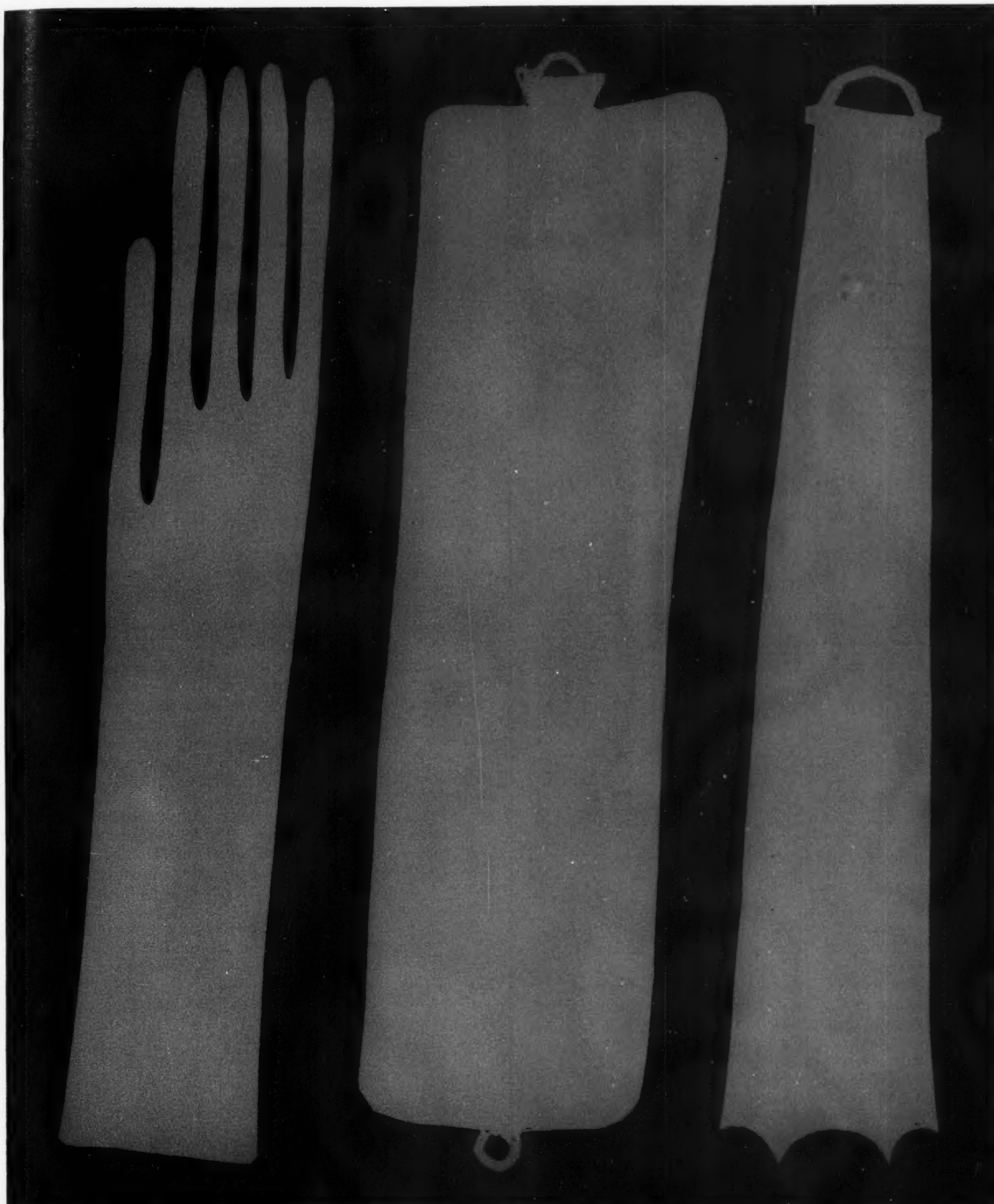
Dry stylus recording thermometer

A new low-cost recording thermometer with dry stylus, designated model 585, has been introduced by The Pacific Transducer Corp., Los Angeles, Calif. It can be used as a portable field service unit for recording time and temperature in land, air, or sea-going vehicles. Small enough to be packed with goods being shipped, it will record in any position, reports the manufacturer. For permanent or temporary mounting, the recorder can be used in cold or hot areas including curing rooms, refrigerators, ovens, institutions, office buildings, factories, and special areas with controlled temperatures, and for special requirements of a variety of industries. For recording temperatures of liquids or wet environments, the instrument may be encased in a polyethylene bag.

The thermometer uses a dry scriber, eliminating ink and making low-temperature recording a practical operation. There is no ink to run on moist paper, to dry up at temperatures above the boiling point, or to freeze at low temperatures.

The thermometer which uses a spring wound clock movement is made in two different time ranges, either 24-hour or 7-day. The device records either 20 to 220° F. or —40 to 160° F. The bimetal actuating element can be reset by the user if the need of recalibration should arise. The overall dimensions of the thermometer are $3\frac{15}{16}$-inch diameter by $2\frac{7}{8}$-inch height. The diameter of the chart is $3\frac{3}{8}$-inches. Weight is 14 ounces. The case is made of black anodized aluminum.

(*Continued on page 646*)



reduce moisture absorption with Columbia-Southern Hi-Sil®

The degree of water absorption is extremely low when you compound with Hi-Sil, a high quality white reinforcing pigment. Your products exhibit less swelling, longer life. That's why so many rubber goods manufacturers specify Hi-Sil for industrial and household products that come in contact with water or a moist environment.

Have you seen Columbia-Southern's new report on the comparative water absorption of various rubber compounds? If not, write for a copy—at no obligation.

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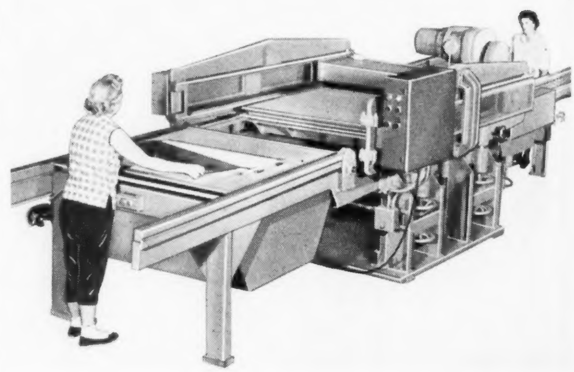
New Equipment

(*Continued from page 644*)



Femco roller die cutter in dual operation

New Model 11327 Roller Die Cutter

Twin die handlers on Model 11327 of the Falls Engineering & Machine Co.'s line of automatic roller die cutters, makes the machine 100% productive during operational time, according to the Cuyahoga Falls, O., firm.

While one die handler is being loaded or unloaded, the other is cutting, doubling the production on one machine.

Two different jobs can be cut on the machine at one time, giving it the utility of two machines. Also, one side can be cut out of production for die changes while the other continues to cut on the same or a different job. Both handlers dump their unloaded parts, giving more speed to the operation.

Materials die cut on Model 11327 in factory demonstrations include open-and closed-cell sponge rubber, urethane foam, cork rubber, foam rubber, cork, rubber asbestos gasket materials, treated paper gaskets, abrasive papers, polyethylene foam, bonded foam rubber, vacuum formed plastics, vinyl foam, and fabrics.

The machine has a die cutting area of 4,300 square inches. Each horizontal die handler has a production or usable area 50 inches wide and 45 inches deep. The machine cycles up to six times a minute.

The Model 11327 equipment includes a vertical die handler which precompresses the stock and positions it firmly on the die while the roll passes over the die. On some materials, several plies may be die cut simultaneously.

Additional information on this model may be obtained from the manufacturer.

Two-Speed Series "600" Electric Hoists

Shaw-Box Crane & Hoist Division, Manning, Maxwell & Moore, Inc., Muskegon, Mich., has expanded its line of Series "600" 'Load Lifter' electric hoists to include single-and two-speed models. Both models are offered in ½- and one-ton capacities, in all standard voltages, with choice of several lifting speeds and various suspensions.

Series "600" electric hoists are modern, lightweight cable-type electric hoists developed specifically to handle high-speed production lifting of 1,000- and 2,000-pound loads. These hoists are widely used in those places where fast, accurate hoisting is necessary to keep work moving on schedule to and from benches, machines, and stockpiles.

The new "two-speed" models fill a particular need of a hoist capable of providing a slow speed to permit close spotting plus a high speed for rapid movement of load before and after spotting. This is accomplished through the use of a two-speed, high-torque squirrel-cage-type motor. Another advantage is an almost constant hoisting and lowering speed in either slow or high range regardless of whether the hook is empty or under

(*Continued on page 648*)

2 POLYMERS

WITH SOLE-SAVING CHARACTERISTICS THAT SET THE PACE

The characteristics of non-staining FRS-146 and 1502 combine easy mixing with more pigment extension for solid rubber soles, more resilience for closed-cell soles and more abrasion resistance for work soles.

Firestone offers you the largest, most complete line of polymers available, plus specially trained Firestone Tech-men to help you produce and market your products . . . without obligation. Just write Firestone Technical Service, Dept. 21-1, Firestone Synthetic Rubber & Latex Co., Akron 1, Ohio.

Firestone

FR-S

SYNTHETIC RUBBER & LATEX CO.
AKRON 1, OHIO
MAKING THE BEST TODAY STILL BETTER TOMORROW

New Equipment

(*Continued from page 646*)

full rated load, which affords the operator the ultimate in control and safety.

Construction features include: modern compact design, offering exceptional low headroom advantages; main suspension frame and end covers of lightweight aluminum alloy castings; lifting drum made from grey iron, with machine cut grooves and large diameter for long cable life; spur-type load gearing made from alloy steel, with teeth machine shaved and heat treated; anti-friction bearings used throughout; two separate brakes, one a Weston-type load brake, and the other a shoe-type motor brake, either capable of holding capacity load; safety upper limit stop to prevent upward overtravel of lower block; 24 volts at push-button, eliminating danger of severe shocks in case of grounds or short circuits.

Additional information is available from the manufacturer.

Bell-Mark Imprinter for Rubber

Lasting imprints of fine quality are automatically placed on tire tread or camelback by new Model 3060 printing attachment, developed for the rubber industry by Bell-Mark Corp., Newark, N. J. Precision engineered and ruggedly constructed for continuous operation, Model 3060 prints by friction contact, assuring consistent application of a bold, sharp trade name or code imprint that is clearly identifiable throughout the entire rubber processing cycle. Easily installed, the unit is said to be virtually maintenance free and to offer a positive, inexpensive means of product identification.

Designed for use in most rubber processing arrangements, the unit has all rollers adjustably mounted on ball bearings and gear-connected to assure constant, positive traction between surfaces. The versatile printing roller can be fitted with adhesive-backed rubber printing plates mounted on sleeves or brass strips.

For printing trade names or code dates the unit is mounted several feet on the conveyor line from the tuber or extruder. As the crude rubber is extruded it passes under the printing attachment where the latter imprints the hot stock preceding immersion into a water bath. An extra-deep ink fountain keeps the unit in operation during continuous production, applying a sharp impression throughout.

Similar Bell-Mark attachments are available for imprinting ply stock and for various other rubber plant applications. Additional information for these and other industrial applications may be obtained from the company.

New Portable Thermistor Psychrometer

A portable thermistor psychrometer called "A+Hygrophil," which accurately measures the moisture content of air by means of wet and dry thermistor beads in a matter of seconds, has been introduced by Atkins Technical, Inc., Cleveland, O. The portability and extremely rapid response features of the pistol-like instrument make it suitable for air moisture determination in a variety of industrial areas. It is particularly useful in industries wherever moisture control is important.

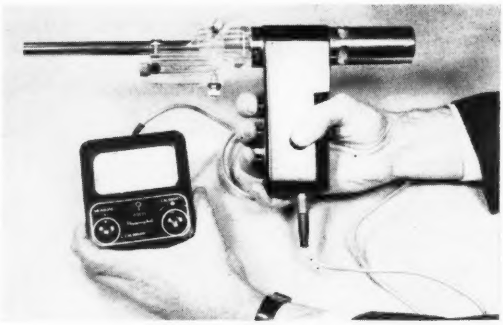
Battery operated, the instrument is completely mobile and can be used to determine the relative humidity of the air in all desired places and in hard-to-reach areas accessible only by a small hole into which an extension of the suction tube of the instrument can be fitted.

The instrument has three scales for measuring humidity in temperatures ranging from 10 to 176° F. (—10 to 80° C.). Accuracy is within 0.5% of relative humidity and readability within ¼° F.

(*Continued on page 650*)

New Equipment

(Continued from page 648)



"A + Hygrophil" Portable Psychrometer

In operation, a trigger button is pressed, and the dry air temperature is immediately read; another button is pushed to read the wet bulb temperature. Both readings are made in less than 10 seconds, and the relative air humidity is quickly read from a conventional psychromatic chart or slide rule.

The instrument contains "Thermophil" temperature sensing probes. In operation, the motor and fan pull air through the barrel around two small thermistors mounted inside. These minute thermo-sensitive beads are made from a germanium based alloy semi-conductor. One thermistor is covered with a thin cotton wick which dips into a water container machined in the Lucite block of the pistol. The very high thermistor resistance temperature coefficient provides great sensitivity to temperatures measured. Wet or dry bulb temperature is indicated directly by the instrument.

To operate in places with explosion hazards, "A+Hygrophil" can be fitted with a spring-coil motor, instead of the battery-powered motor of the standard design.

Further information on this instrument is included in Bulletin HHVM, offered by the manufacturer.

New Model R-18 Rubber Slitter

The Doven division of Appleton Machine Co., Appleton, Wis., has developed a new Model R-18 rubber slitter for use in the slitting and rewinding of difficult materials such as solid and silicone rubber, heavy-gage plastics, leather, and other materials. This unit will slit as narrow as 1/8-inch and can handle webs up to 18 inches wide. Polyurethane foam and sponge rubber up to one inch in thickness can also be handled on this slitter. Principal features include the control over stretch and distortion while slitting and the absence of fusing or interleaving while rewinding.

Ozono

(Continued from page 616)

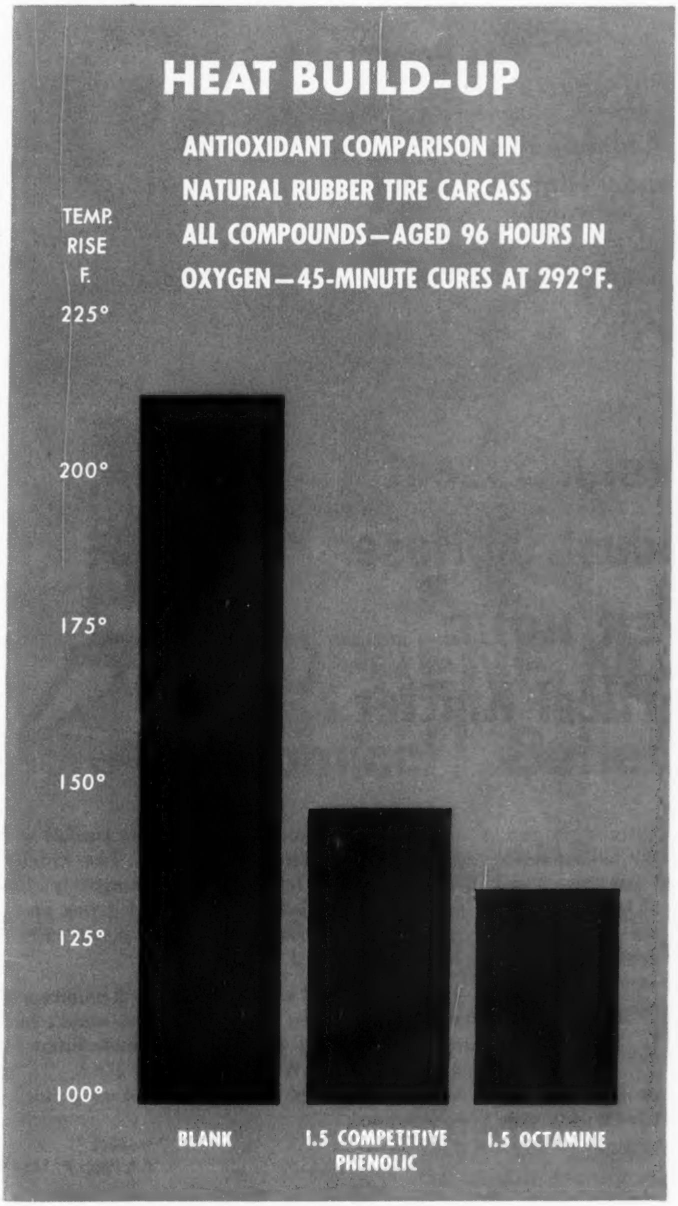
Some physical properties of Ozono are reported as follows:

Form	pellets
Melting point	225° F.
Specific gravity	0.98
Storage stability	good
Solubility	Soluble in gasoline, benzene, carbon tetrachloride, methylene chloride. Slightly soluble in acetone. Insoluble in water.
Toxicity	Said to be non-toxic

Additional information on Ozono is available from the company.

NAUGATUCK

OCTAMINE



gives maximum carcass protection ...minimum white sidewall discoloration

Air permeating through the carcass of a rapidly flexing tire causes the carcass compound to deteriorate. This deterioration combined with heat build-up leads to carcass failure and subsequent blowouts.

The graph illustrates the resistance of an OCTAMINE-protected compound to heat build-up in a Goodrich flexometer test after oxygen bomb aging.

OCTAMINE *maintains new-tire carcass performance* after severe aging. This strong secondary amine performs better than nonstaining phenolics which lose effectiveness in carbon black compounds.

The use of OCTAMINE as a carcass protectant guards against objectionable migration-staining through white sidewalls.

In easy-to-handle granulated form, OCTAMINE offers you the protection you need, not only for tires, but for mechanical goods, sundries, soling and a score of other rubber products. Learn more about OCTAMINE and its important advantages by writing to us for Compounding Research Report No. 20.

Naugatuck Chemical

Division of United States Rubber Company 210R Elm Street Naugatuck, Connecticut

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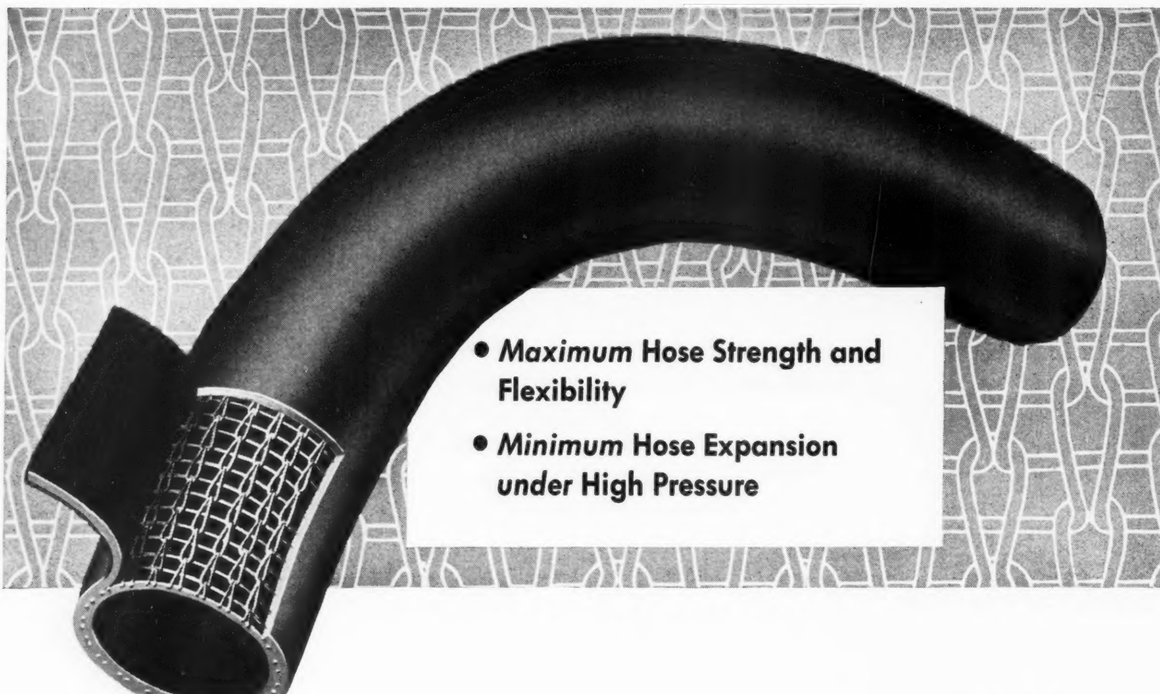
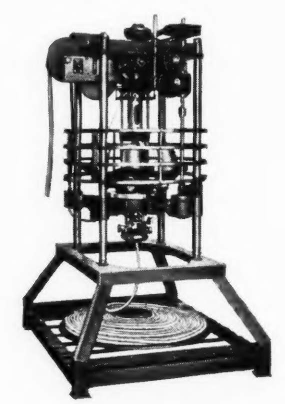


New Lock Stitch* Reinforcement for Automotive and Industrial Hose at 1,000 FEET PER HOUR with the FIDELITY Vertical Knitter



Knit rayon, cotton, nylon — all natural or synthetic yarns on rubber hose extrusions in continuous lengths; at speeds up to 1,000 feet per hour. Fidelity's new *lock stitch* method of hose reinforcement assures the positive resistance to expansion under pressure, required for today's automobile radiator, windshield wiper, gasoline and heater hose, as well as other types of industrial rubber hose. Hose is strong *and* flexible, adhesion is better . . . diameters are uniform . . . expansion is restricted.

Electrically controlled Fidelity Hose Reinforcement Knitters are setting new standards for quality hose production *and* economy never before possible with conventional Braiding machines. The Fidelity method utilizing less floor space, completely eliminates costly rewinding, treating and drying operations . . . takes yarn direct from 10 pound cones — requires no special package.

Learn for yourself why Fidelity Hose Reinforcement Knitters have been the choice of the world's foremost Rubber and Plastic Hose Manufacturers for nearly 25 years. Write for Catalog HRA . . . or visit our Philadelphia showrooms and see a Fidelity in operation.

*Patented
U. S. Patent #2,788,804

Designers and Builders of Intricate, Automatic Precision Machines

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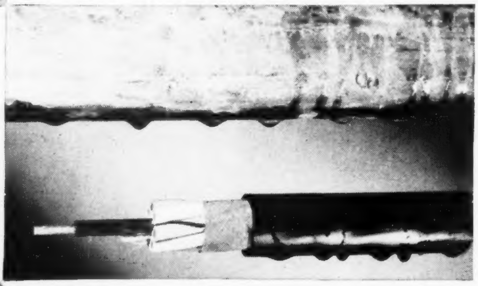
Harflex 330 contributes to freedom from objectionable high taste and odor transfer to food from refrigerator gaskets.

NEW FREEDOM FROM HIGH HEAT AND HUMIDITY SPEW

Harflex 330 features good electric properties, including high dielectric strength both dry and after immersion in water, plus rugged resistance to copper corrosion



NEW FREEDOM FROM VINYL UPHOLSTERY PROBLEMS

Harflex 330 imparts durability and permanent flexibility to vinyls despite their subjection to perspiration, oil, soil, frequent washing with soapy water or chlorinated solvents, humidity, heat and sunlight.

Columbian Carbon Company, Distributor To The Rubber Industry

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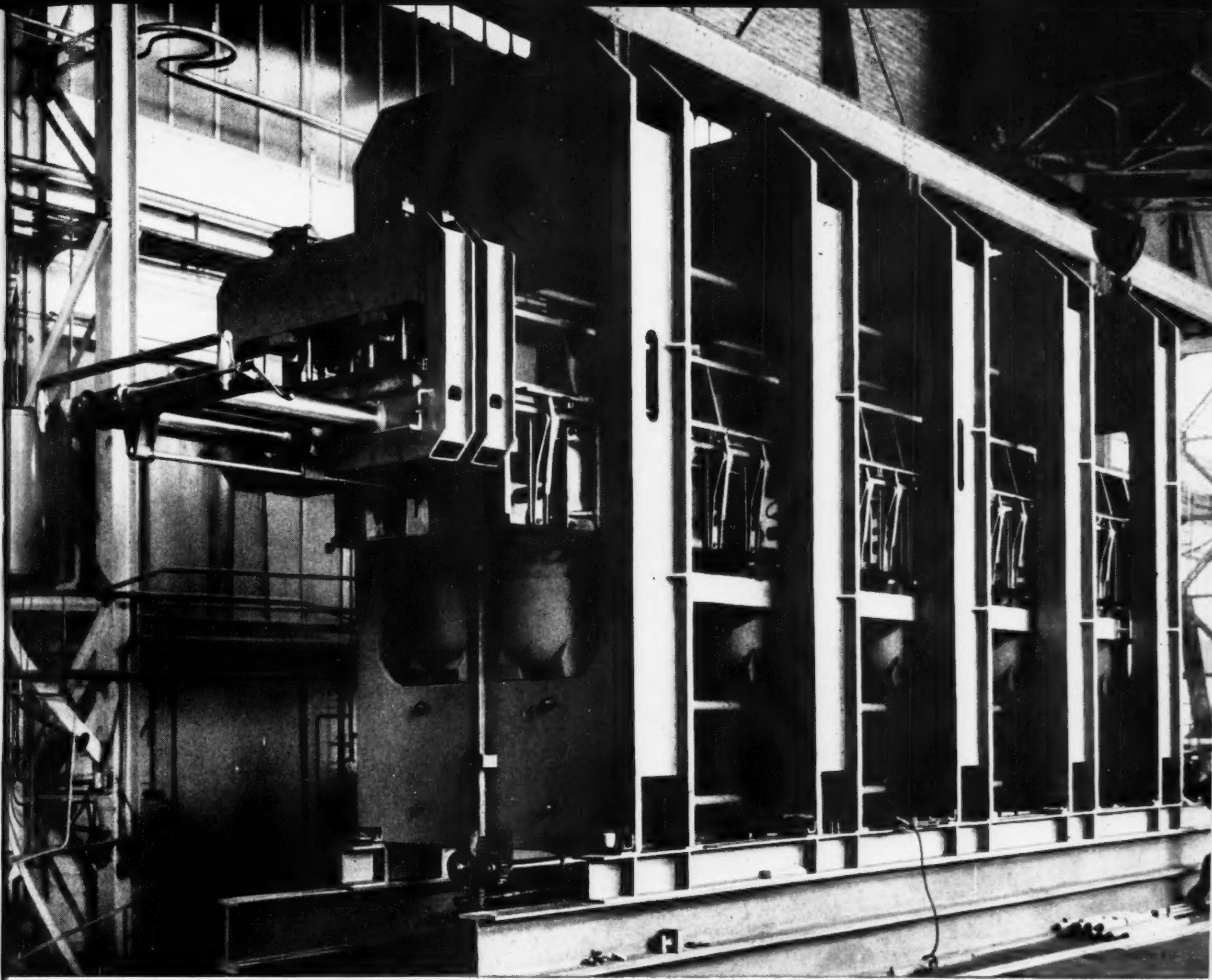
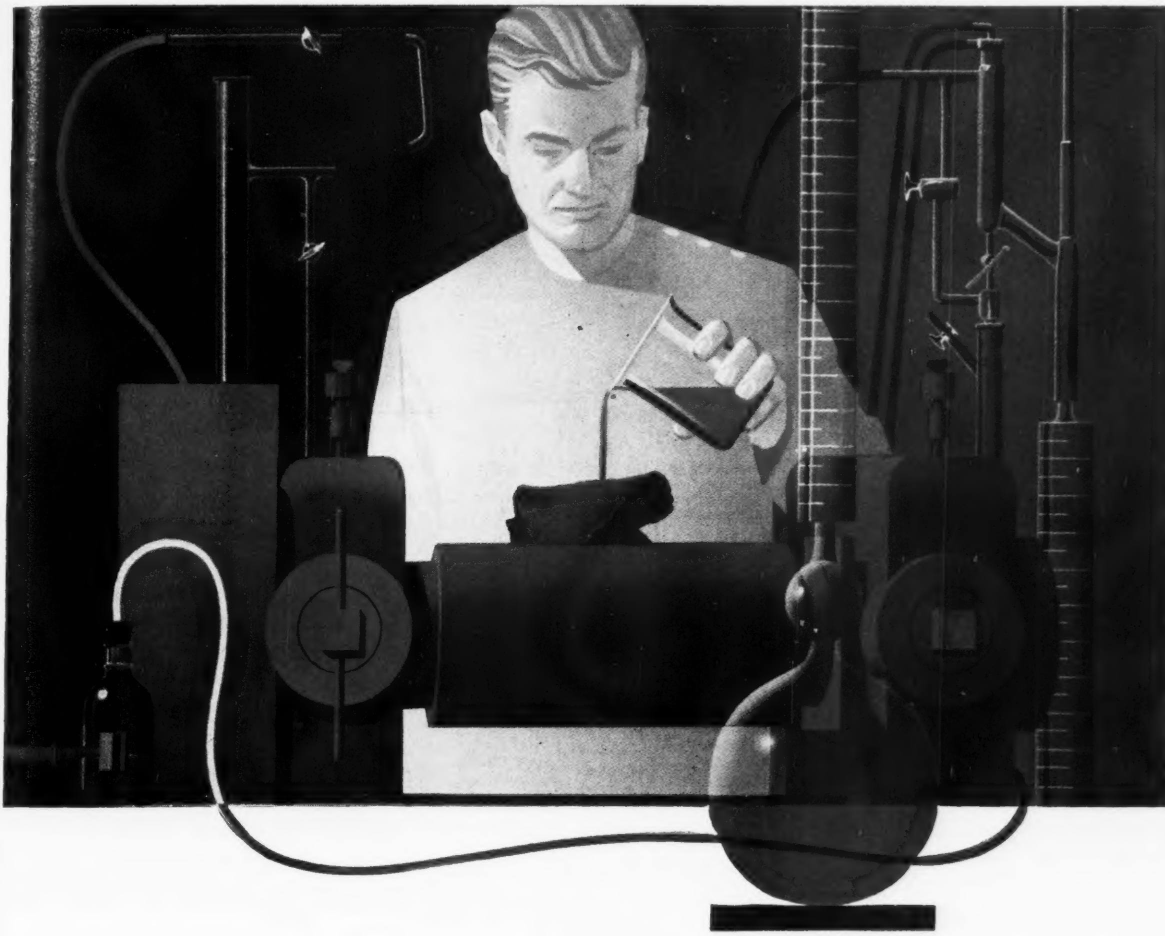
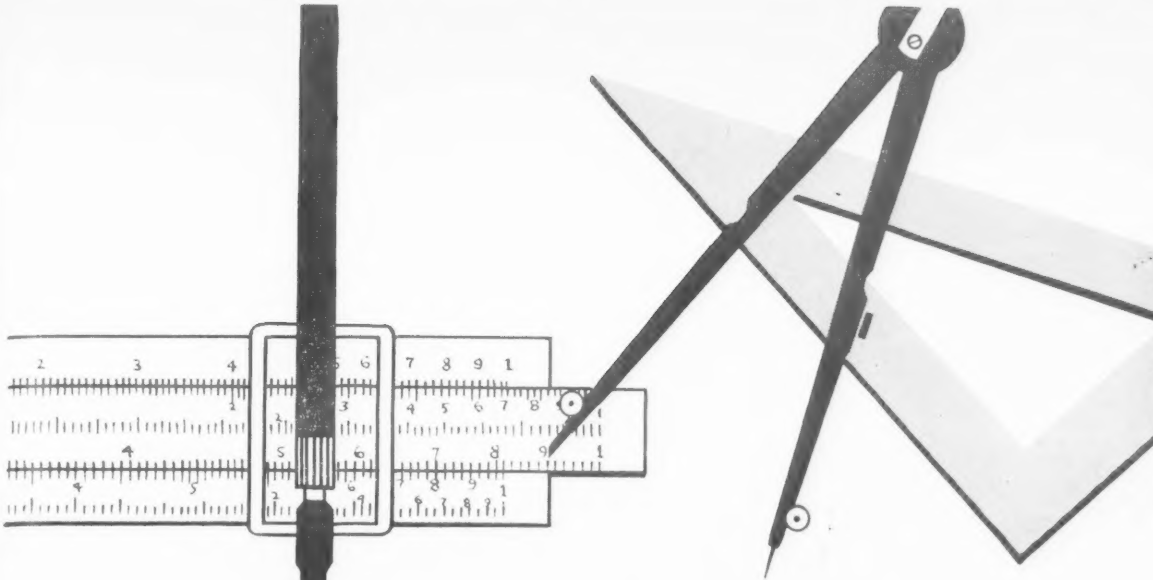
Write for Sample and Bulletin
or see Chemical Materials Catalog - Pages 173-175.







RUBBER WORLD
EDITORIAL

Competition among Rubbers In the Sixties

COMPETITION among rubbers, both natural and synthetic, appears likely to become much greater in the Sixties than in the decade just ended. This competition will be due both to the expected continuing increase in world consumption of new rubber from about 4.2 million long tons in 1960 to more than 7.0 million tons in 1970, and to the demand in the next decade for rubbers with a wider range of properties than ever before.

The above consumption estimates, which include those for the Soviet bloc countries, mean that about 4.7 million tons of synthetic rubber capacity will be necessary by 1970, since natural rubber production is not expected to increase to more than 2.3 million tons. World synthetic rubber production capacity in 1960 may be estimated at somewhat more than 2.6 million tons, so that around 2.0 million tons' additional capacity will have to be built in the next 10 years. Soviet bloc countries plan about 1.0 million tons' more synthetic rubber capacity by 1965; if this is not achieved, a greater amount of capacity will have to be built by Free World countries.

In building this additional capacity, the pattern of usage by types may change. Styrene-butadiene rubber, particularly those grades containing oil and/or carbon black, is the best buy in the general-purpose field at the present time. With further improvements in polymers, oils, and blacks, SBR will undoubtedly retain the major share of this market. Although natural rubber production is not expected to increase enough to regain its position as the largest-volume rubber, improvements in quality, service, and new grades, possibly including black masterbatches, will aid the natural variety in selling all that can be produced.

Butyl rubber has always aimed at replacing natural rubber and is now trying to replace some SBR in the passenger-car tire field as well as in many non-tire products. Synthetic *cis*-polyisoprene still cannot compete with SBR or butyl rubber on a price basis, but will become more of a competitor for natural rubber, since both have the properties suitable for use in large truck tires. Then there is *cis*-polybutadiene, which is striving to gain a foothold in the tire and some other fields as a replacement for natural, synthetic natural, SBR, and butyl.

Among the newer rubbers about which very little published information is available, but which could become competitive eventually with all of the above general-purpose rubbers, is ethylene-propylene copolymer rubber. This rubber, if it could be marketed for 25¢ a pound, and if its processing and curing could be improved, might become a serious competitor.

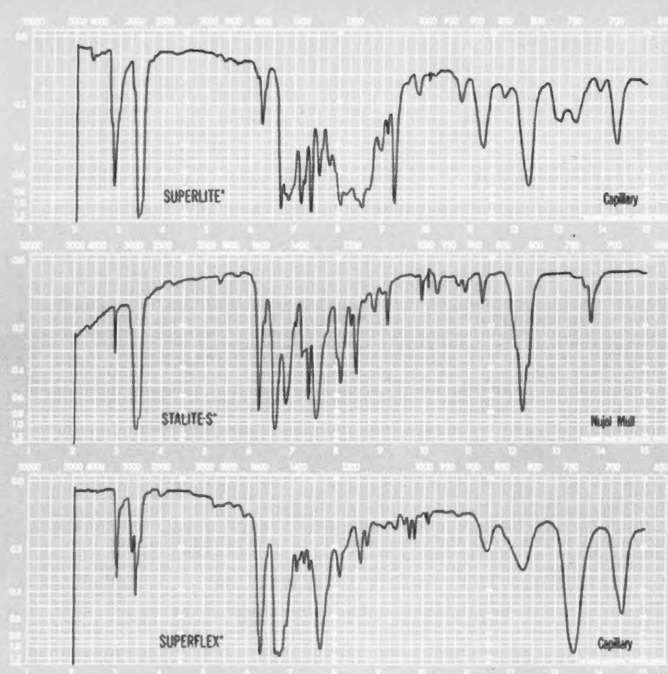
Competition among specialty rubbers will be no less intense as older types improve their properties to meet more difficult service requirements, and additional new types are developed.

Competition among rubbers in the Sixties will be a boon to consumers and will do much to accelerate the growth of the rubber products manufacturing industry.

R. G. Seaman
EDITOR

"Tailor made"

AGERITE* Antioxidants



*U. S. Registered Trademark

to fit your special compounding requirements

If you require:	**We recommend:**
nonstaining, non discoloring protection for white and pastel stocks	AGERITE ALBA
easier processing, good aging neoprene	AGERITE GEL
long life in heavy duty outdoor applications	AGERITE HP
maximum flex resistance	AGERITE HIPAR
good low cost protection where color is not important	AGERITE POWDER
heat resistance and ozone protection	AGERITE RESIN D
nonstaining with low discoloration in light	AGERITE SPAR
longer life and lower scorch rate in neoprene	AGERITE STALITE or AGERITE STALITE S
an SBR polymer stabilizer and heavy duty antioxidant	AGERITE SUPERFLEX
a nonstaining and non discoloring SBR stabilizer and antioxidant	AGERITE SUPERLITE
a copper inhibitor and strong general purpose antioxidant	AGERITE WHITE

R. T. Vanderbilt Co., Inc.
230 PARK AVENUE • NEW YORK 17

RUBBER WORLD

Butyl Tire Tread Abrasion[1]

Designed Compounding Experiments Coordinated with Road Wear Tests

By R. L. ZAPP, C. W. UMLAND, II, and L. R. SPERBERG
Enjay Laboratories, Linden, N. J. *Three-T Fleet, Inc., Odessa, Tex.*

RUBBER compounding lends itself to designed experiments because of the large number of variables that exist in a normal rubber compound. An orthodox experiment, where an effort is made to study one variable at a time, often results in an unwieldy number of compounding variations. To coordinate such experiments with expensive road-wear tests imposes prohibitive financial burdens as well.

In a designed experiment, all the variables of interest are varied simultaneously according to a set pattern, and much information can be gained from a greatly reduced number of experiments. The designed experiment is capable of showing how strongly an individual variable can assert itself, and this effect can be assigned a statistical significance.

The Designed Experiment

During one phase of the butyl tire development it was necessary to know which of the many ingredients in a tread formulation most significantly affected abrasion resistance or road life. Even simple tire compounds have eight or ten ingredients; so, to make a workable design, certain of these would have to be held constant. Based upon considerations explained below, four definite ingredients were selected as the variables.

[1] Presented before the Division of Rubber Chemistry, ACS, Los Angeles, Calif., May 15, 1959.
[2] R. L. Zapp, RUBBER WORLD, 133, 1, 59, (1955); *Rubber Chem. Tech.*, 29, 33 (1956).

TABLE 1. TYPICAL BUTYL RUBBER TIRE TREAD INGREDIENTS

	TYPE OF INGREDIENT	PARTS BY WT
ENJAY BUTYL 218	CONSTANT	100
SAF CARBON BLACK	VARIABLE	30, 40, 50, 60
ELASTOPAR *	VARIABLE	0, 0.5, 1.0, 1.5
OIL (NECTON 60)	VARIABLE	0, 5, 10, 15
ZINC OXIDE	CONSTANT	5
SULFUR	VARIABLE	0.5, 0.75, 1.0, 1.5
ACCELERATORS		
TDEDC †	CONSTANT	
BTDS ‡	CONSTANT	

* N-METHYL N-NITROSO P-NITROSO ANILINE — MONSANTO CHEMICAL CO.
† TDEDC — TELLURIUM DIETHYL DITHIOCARBAMATE
‡ BTDS — BENZOTHIAZYL DISULFIDE

Variable and Constant Compounding Ingredients

The typical components of a butyl tread compound are listed in Table 1. It should be remembered that we are confining the study to that portion of a tire which contacts the road surface. Adjacent to each individual component is an indication of its assignment to a constant or variable role.

For maximum abrasion resistance, other experiments[2] have shown that the higher molecular weight polymer yields the greater abrasion resistance; so Enjay Butyl 218 was used and assigned a constant role.

C. W. Umland

L. R. Sperberg

R. L. Zapp

The Authors

Robert L. Zapp, research associate of Esso Research & Engineering Co., at present doing liaison work in chemistry in Europe, received his B.S. in Ch. Eng. from the University of Michigan in 1935. After one year of special graduate work at the University of Pittsburgh, he was a fellowship assistant at the Mellon Institute from 1936 to 1938.

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He is a member of the ACS and its Rubber Division and the New York Rubber Group.

Lawrence R. Sperberg, president, Three-T-Fleet, Inc., received his B.S. in chemistry from Hillsdale College in 1934, his M.S. from the University of Michigan in 1935, and did graduate work in chemistry at the University of Akron.

Mr. Sperberg was a research chemist and compounder at Goodyear Tire & Rubber Co. from 1935 to 1938, and then became chief chemist for Cia. Cubana de Caucho in 1938 and 1939. He was director of the rubber laboratory for Phillips Petroleum Co. from 1940 to 1950 and then was employed as chief chemist for the Borger division of J. M. Huber Corp. in 1950 and 1951. He managed the rubber laboratory for the Sid Richardson Carbon Co. from 1953 until 1955.

Mr. Sperberg is a member of the American Chemical Society and its Rubber Division and of the Aircraft Owners & Pilots Association. He is a past chairman of the Panhandle Plains Section, ACS, and a councillor of the Permian Basin Section.

Carbon black as the reinforcing filler is variable only in quantity. The fine SAF black types produce the maximum in reinforcement while maintaining fair extrusion properties.

Other constant roles were assigned to zinc oxide and the accelerators of vulcanization. In the latter case, we have generally recommended the use of the tellurium derivative of dithiocarbamic acid for resistance to reversion; the benzothiazyl disulfide, as a secondary accelerator, has provided a measure of processing safety. As indicated in Table 1, the other variable ingredients are Elastopar,[3] which promotes pigment-polymer interaction; the plasticizing oil, which varies the softness and dynamic modulus of the vulcanizate; and, finally, sulfur, which will control the extent or concentration of crosslinks in the vulcanized network. We have, then, four variable ingredients and four constant ingredients.

The Graeco-Latin Square Design

To study the effect of these four variables, they were assigned four concentration levels so that the experiment could be fitted into the Graeco-Latin Square de-

[3] N-methyl-N, 4 nitrosoaniline 33⅓%; inert filler, 66⅔%; Monsanto Chemical Co., St. Louis, Mo.

Butyl Tire Tread Abrasion

A study of the effect of the variation of certain ingredients in a butyl rubber tire tread compound on laboratory abrasion resistance was accomplished with far fewer experiments by the designed experiment method than would have been possible with orthodox-type experiments where one variable is studied at a time.

Compounds similar to those used in the laboratory experiments were then employed in tread caps of experimental butyl rubber tires and tested for road wear at 70 miles per hour. Good correlation between laboratory experiment results and tire road tests was found.

The laboratory experiments showed that the most significant improvement in abrasion resistance (35%) was obtained by reducing the sulfur content of the formulation from 1.5 parts to 0.5 part per 100 of rubber. The next most significant improvement in abrasion resistance was obtained by reducing the carbon black content from 60 to 40 pphr.

Experimental butyl rubber tires in which the sulfur content of the tread cap compound was lowered from 1.5 to 0.5 pphr. and the carbon black content held at 40 pphr. indicated a road life improvement of 30%.

sign.[4, 5] Such a design is shown symbolically in Figure 1 where the four ingredients, sulfur, oil, Elastopar, and carbon black, are represented by the letters "S," "N," "E," and "B," respectively, and the subscripts are indicative of the four concentration levels given in Table 1. The basis of this design is that any concentration level of any ingredient appears once and only once in any column (or row).

Since abrasion resistance is of primary importance in a tread compound, the effect of the four levels of these variable ingredients upon laboratory abrasion resistance was determined. For this purpose the Lambourn abrader was used in these laboratories.[2, 6, 7] Laboratory compounds were mixed and tested according to this scheme; abrasion loss values determined on the vulcanizates were placed in the proper box of the 16-square design. Each abrasion loss value is the average of three individual measurements.

To show just how this Graeco-Latin Square design is related to the total possible number of experiments, a pattern has been made up as shown in Figure 2. Here the 16 combinations of Figure 1 are placed as solid squares in the total number of possible experiments. As one can see from this pattern, the total possible number of experiments would be 4^4 or 256 if all the combinations of the four levels of all the variable ingredients were studied. By this design, the number of experiments has been vastly reduced, but if the effect of an ingredient is real, it should assert itself with statistical significance.

[4] "Industrial Experimentation," K. A. Brownlee, American Third Edition. Chemical Publishing Co., Brooklyn, N. Y. (1949).
[5] "Design and Analysis of Industrial Experiments," O. L. Davis *et al.* Hafner Publishing Co., New York, N. Y. (1956).
[6] J. W. Adams *et al.*, *Rubber Chem. & Tech.*, 25, 191 (1952).
[7] E. F. Powell and S. W. Gough, RUBBER WORLD, 132, 2, 201 (1955).

	S_1	S_2	S_3	S_4
N_1	E_1B_1	E_2B_2	E_3B_3	E_4B_4
N_2	E_2B_4	E_1B_3	E_4B_2	E_3B_1
N_3	E_3B_2	E_4B_1	E_1B_4	E_2B_3
N_4	E_4B_3	E_3B_4	E_2B_1	E_1B_2

BASIS OF DESIGN–
ANY CONCENTRATION LEVEL OF ANY INGREDIENT APPEARS ONCE AND ONLY ONCE IN ANY COLUMN (OR ROW)

Fig. 1. Graeco-Latin Square design of experiment for four variables at four levels. "S" rpresents sulfur; "N," processing oil; "E," Elastopar; and "B," carbon black

TABLE 2. TREATMENT OF ABRASION DATA FROM GRAECO-LATIN SQUARE DESIGNED EXPERIMENT

NECTON 60	SULFUR S_1 0.5	S_2 0.75	S_3 1.0	S_4 1.5	B
(N_1) 0	.27 (E_1B_1)	.32 (E_2B_2)	.48 (E_3B_3)	.67 (E_4B_4)	(B_1) 1.53/4
(N_2) 5	.41 (E_2B_4)	.39 (E_1B_3)	.47 (E_4B_2)	.46 (E_3B_1)	(B_2) 1.52/4
(N_3) 10	.31 (E_3B_2)	.40 (E_4B_1)	.45 (E_1B_4)	.47 (E_2B_3)	(B_3) 1.65/4
(N_4) 15	.31 (E_4B_3)	.42 (E_3B_4)	.40 (E_2B_1)	.42 (E_1B_2)	(B_4) 1.95/4
EX.	1.30/4	1.53/4	1.80/4	2.02/4	6.65

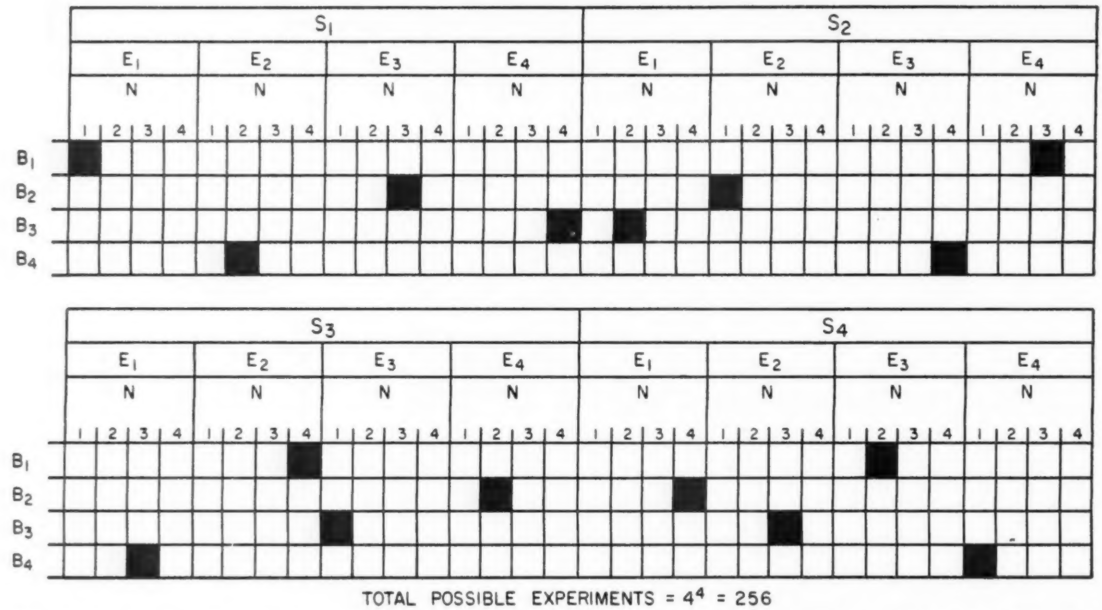


Fig. 2. Design pattern for Graeco-Latin Square designed experiment in which only 16 (solid blocks) out of 256 possible experiments were found to be necessary

Laboratory Abrasion and Variations in Compounding Ingredients

Compounding ingredients were mixed in small laboratory Banbury mixers. The butyl polymer, carbon black, and Elastopar were given a heat treatment prior to the addition of plasticizing oil. Mixing time for the masterbatch (without curatives) was 10 minutes. Maximum mixing temperatures were 320 to 330° F., sufficient to insure pigment-polymer-promoter action when Elastopar was present.[8] Zinc oxide was added during the final two minutes of the 10-minute cycle. Sulfur and accelerators were added on a small two-roll mill with reduced temperatures. The exact levels of the four variable ingredients have been given in Table 1 and are repeated for the sulfur and processing oil with the laboratory abrasion results of Table 2.

Treatment of the Results

Table 2 again shows the Graeco-Latin Square design. Vertically, N_1 through N_4 represent the four levels of oil concentration from 0 to 15 pphr. Along the horizontal there are four levels of sulfur, 0.5 to 1.5 pphr. Elastopar is varied in four levels from 0 to 1.5 pphr., and the SAF carbon black in four levels from 30 to 60 pphr., according to Table 1. All concentrations are expressed in parts by weight per hundred parts of butyl rubber. The combinations of Elastopar and black are shown in each individual square by their numeral subscripts. As stated before, in this design any one level of any ingredient appears once and only once in any column (or row). The decimal figures in each individual square represent the laboratory abrasion loss values determined on the Lambourn abrader. These values are in terms of cubic centimeters lost per kilometer run per ampere of d.c. electrical current to a magnetic brake.

For treatment of the data, let us confine our explanation to just the effects of sulfur and carbon black. To determine the individual effect of each level of an ingredient, the following mechanics are observed. The abrasion values of all compounds containing 0.5-part of sulfur are summed as shown at the bottom of the first column. This is done for each level of sulfur. By dividing these sums by four, one determines the average of all abrasion values for compounds containing only one level of sulfur.

This same procedure is followed for the carbon black level, although here the path following just one level of the ingredient is not a straight row or column. The dotted line superimposed on the design follows those combinations that have the B_1 level of carbon black concentration. The abrasion values of these combinations connected by the dotted line are summed up and placed at the top of the column headed "B." The same procedure is then followed for all combinations containing just the level B_2 of carbon black. The second sum is also placed under the column headed "B." This is done for the four levels of carbon black and again the average of the abrasion values containing only one level of carbon black is determined by dividing each of these figures by four. The effects of the other ingredients, oil and Elastopar, can be obtained in the same fashion.

Individual Effects of the Variables

In Table 3, the average abrasion values of those compounds containing only one level of one ingredient

[8] H. M. Leeper, C. L. Gable, J. J. D'Amico, C. C. Tung, *Ibid.*, 135, 3, 413 (1956).

Table 3. Average of Abrasion Loss Values for Each of Four Levels of Four Ingredients

S	B	E	N
$S_1 = 0.33$	$B_1 = 0.38$	$E_1 = 0.38$	$N_1 = 0.44$
$S_2 = 0.38$	$B_2 = 0.38$	$E_2 = 0.40$	$N_2 = 0.44$
$S_3 = 0.45$	$B_3 = 0.42$	$E_3 = 0.42$	$N_3 = 0.41$
$S_4 = 0.51$	$B_4 = 0.49$	$E_4 = 0.46$	$N_4 = 0.39$

VALUES IN CC/KM/AMP

are listed. The greater the change of abrasion values with concentration level, the greater will be the extent to which the ingredient asserts itself.

From a casual observation of the listed averages, it can be seen that the levels of sulfur and perhaps the levels of carbon black produce the greatest changes in abrasion loss values. This has been portrayed graphically in Figure 3, for sulfur and SAF carbon black, and in Figure 4 for Elastopar and the oil plasticizer. In these figures, the average effect of each individual ingredient is plotted as a function of its concentration level. The steepness of the curves indicates to what extent the concentration of an individual ingredient is able to assert itself in the designed experiment.

It is quite apparent from an observation of the four individual graphs that sulfur level has a profound effect on resistance to abrasion, for as sulfur is reduced from 1.5 parts to 0.5-part, abrasion losses drop about 35%. The next most important variable is the level of carbon black. A 20% reduction in abrasion loss is realized when black content is lowered from 60 to 40 parts. A leveling off of the curve at this point indicates that little or no benefit would be gained by further reduction in carbon black level. It is therefore not surprising that in our compounding work we have settled on approximately a 40-part level for a fine reinforcing black.

The effects of Elastopar and oil, as shown in Figure 4, are much less significant. The trend appears to indicate that lower Elastopar will result in lower abrasion loss; although in our compounding work, in *tread caps only*, we have maintained a small level of Elastopar to insure more uniform factory mixed compounds. Oil content appears to have a reverse effect (i.e., higher oil content produces lower abrasion losses). However, as will be shown later by a variance table, this effect is within the error of the experiment.

Table 4. Summary of Variance and Variance Ratio

SOURCE OF VARIANCE	MEAN SQUARE *	DEGREES OF FREEDOM	VARIANCE	VARIANCE RATIO †
SULFUR	739	3	246	9.97
SAF CARBON	302	3	101	4.08
ELASTOPAR	142	3	47	1.92
OIL	61	3	20	0.82
RESIDUAL	74	3	25	1.00
TOTAL	1318	15		

* DECIMAL VALUES CHANGE TO WHOLE NUMBERS IN CALCULATIONS

† VARIANCE RATIO = VARIANCE/RESIDUAL

Statistical Significance of the Results

A feature of a statistically designed experiment is the ability to estimate the significance of the results. Through calculations based on the sums of squares, the significance of the sources of variance can be determined. Detailed calculations may be followed in the Appendix. The results of such a series of calculations are presented in Table 4.

By dividing the sum of the squares of the deviations from the average (i.e., the mean square) by the degrees of freedom, the variance column is obtained. Then by dividing each of the individual values by the residual value,[9] the variance ratio for each compounding in-

[9] This is a measure of unexplained variance (experimental error).

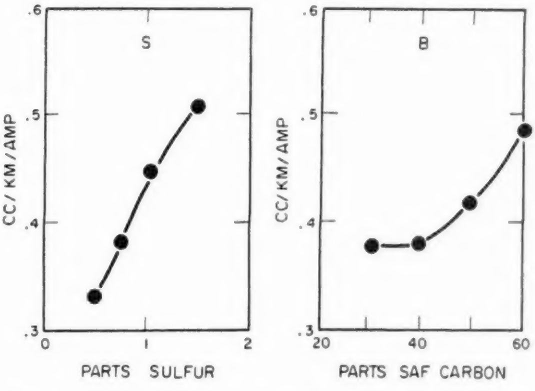


Fig. 3. Individual effects of variable ingredients (sulfur, SAF carbon black) on abrasion loss

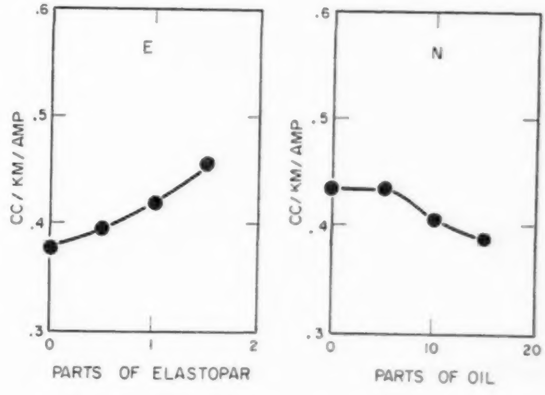


Fig. 4. Individual effects of variable ingredients (Elastopar, processing oil) on abrasion loss

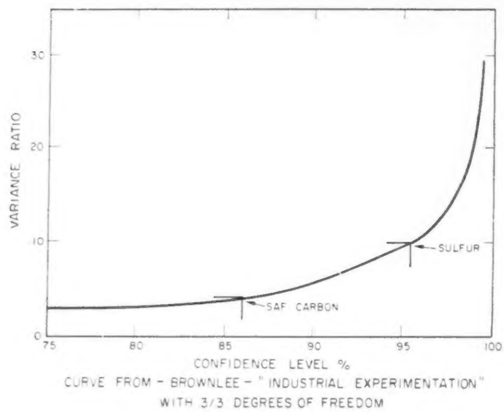


Fig. 5. Significance of test results for sulfur and carbon black in butyl rubber tire tread compounding experiments

gredient effect is determined. A comparison of this variance ratio with a statistically established relation between confidence level and variance ratio is then made. Such a relation can be obtained in any of the several volumes [4,5,10] on statistical experiments; it is presented in graphed form in Figure 5.

Now, let us superimpose on this curve the variance ratios that were obtained for the effect of the various compounding ingredients. Sulfur, for example, had a variance ratio of 9.97. If this number is positioned on the curve, one can observe that the confidence level of the effect of sulfur is significant at above 95%. For

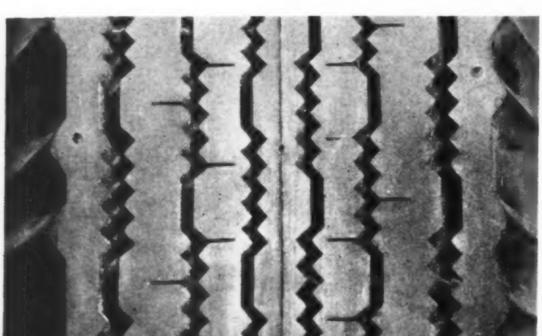


Fig. 6. Tread design of butyl rubber tries which were used in road-test experiments

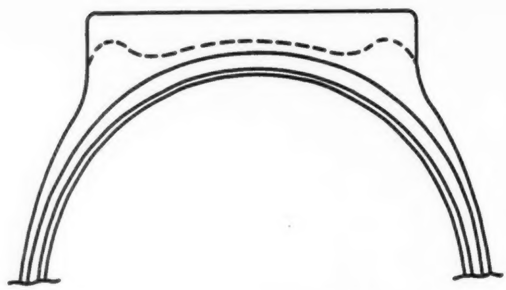


Fig. 7. Two-piece tread profile of butyl rubber tires which were used in road tests. Tread cap compounds were formulated according to Table 5

the effect of carbon black a variance ratio of 4.08 was obtained. Placing this value in its proper position on the curve, one sees that the effect of carbon black on abrasion resistance is less significant than that of sulfur level and falls just above the 85% confidence level. The effects of other ingredients are much smaller since their variance ratios are all below two.

From these laboratory experiments the following conclusions can be made:

1. The effect of sulfur level is significant at the 95% confidence level. Abrasion losses decrease as sulfur is reduced to 0.5 pphr.

2. The effect of SAF carbon black loading is significant at the 85% confidence level. The trend toward lower abrasion losses with reduced carbon black loading is maintained until the level of 40 pphr. is reached. Further reductions in carbon black loading would have little significant effect on abrasion loss.

3. The effect of oil and Elastopar appears much less significant, but lower Elastopar does seem to tend toward lower abrasion losses, probably because extensibilities of compounds containing high levels of Elastopar are reduced. The variance for the oil content is similar to the residual; so its effect is within the experimental error.

4. There do not appear to be any interactions between the four variable ingredients which affect abrasion losses. This point is indicated by the low mean square and the variance of the residual in relation to that of the sulfur level or carbon black loading.

Road-Test Results

Fabrication of Butyl Tires

In the final analysis, laboratory tests cannot take the place of road tests. They do, however, permit selectivity with regard to the choice of compounds most likely to show improved wear characteristics in road-wear evaluations. Following the dictates of the statistical analysis places the odds strongly in favor of a successful road test.

The tread design used in all of the road-wear studies reported here has an essentially straight running rib pattern consisting of seven bars and six grooves with very moderate traverse siping. Such sipes as there are

[10] D. S. McArthur, unpublished work (Aug. 28, 1950). Esso Research & Engineering Co., Linden, N. J.

run up to about two-thirds of the width of the tread bars in which they appear. A picture representation of this tread design is shown in Figure 6. All tires tested were 8.00-14 four-ply tubeless blackwalls. Both SBR and butyl rubber control tires were included in all tests.

The tires were fabricated at the Enjay Laboratories pilot-plant facilities maintained through the courtesy of the Dunlop Tire & Rubber Corp. at Buffalo, N. Y. Conventional factory equipment and methods were used throughout their manufacture.

All tires were constructed with a two-piece tread. A typical tread profile is shown in Figure 7 as it would appear in a cured tire. The undertread sidewall portion consisted of the same compound for all butyl test tires. The tread cap compounds were varied. The tread formulations which will be under discussion for the balance of the paper are listed in Table 5. All tread cap variations are based on the results of the designed experiments described earlier.

The carcass plies were made by treating the tire cord with a resorcinol-formaldehyde-butyl latex dip. After the cord treatment, butyl rubber carcass stock was calendered on to the cord. Tubeless tire innerliner was applied to the first plies in a separate calender operation. The carcass plies were then bias-cut prior to building to yield a cured crown cord angle of approximately 37 degrees.

The tires were built with three plies under the bead and one over. The beads consisted of five turns of four-strand bead wire insulated with a butyl-chlorosulfonated polyethylene covulcanizate. They also had a stepped off, bias-cut, reinforcing flipper. All tires were cured in a Bag-O-Matic press.[11]

Description of the Road Test

Performance tests on the road constitute the final and most important evaluation of a tread compound. A procedure was set up which is severe, but realistic, and which meets the present practices of tire testing by rubber and automotive companies. This test was devised to give a wear level of 35-40 miles/mil for SBR tires.

The high-speed test procedure used for obtaining all road data reported here was developed in cooperation with the Three-T-Fleet, Inc., Odessa, Tex. The tests were run over a 180-mile course of typical West Texas macadam roads. All tires were run on 1958 Pontiacs at sustained speeds of 70 mph. except for two mountainous and curvy sections where speeds of 50 and 60 mph. were run for 20 and 10 miles, respectively. The tires were inflated at 24 psi. (cold) and carried 100% loads as specified by the Tire & Rim Association. Mileage was accumulated at the rate of about 1,000 miles/day for a total of approximately 10,000 miles. Tires were switched between vehicles, but kept on the same axle at odd thousands of miles. At even thousand-mile intervals the tires were switched in pairs to a different axle as well as to a different vehicle. Inspections and measurements were made every 2,000 miles.

[11] McNeil Machine & Engineering Co., Akron, O.

TABLE 5. BUTYL RUBBER TREAD FORMULATIONS FOR ROAD TESTS

	1.5S	0.75S	0.5S
ENJAY BUTYL 218	100	100	100
SAF BLACK	45	40	40
ELASTOPAR	1.5	0.5	0.5
ZINC OXIDE	5	5	5
STEARIC ACID	1	1	1
PROCESS OIL	15	10	5
SULFUR	1.5	0.75	0.5
TDEDC	1.0	—	1.0
TMTDS *	—	1.0	—
BTDS	1.0	1.0	1.0

* TETRAMETHYL THIURAM DISULFIDE

Road-Wear Results

The first indication of improved butyl tire wear under conditions of sustained high-speed driving was observed early during the Summer of 1958. The improved abrasion resistance was achieved with compounds employing the low cure state concept developed from the experiments described earlier. At that time, sulfur level in the tread cap had been reduced only to 0.75 pphr. Since then, 70-mph. road tests have been completed on tires using as little as 0.5 pphr. of sulfur.

Figure 8, a plot of tread loss *versus* mileage, shows

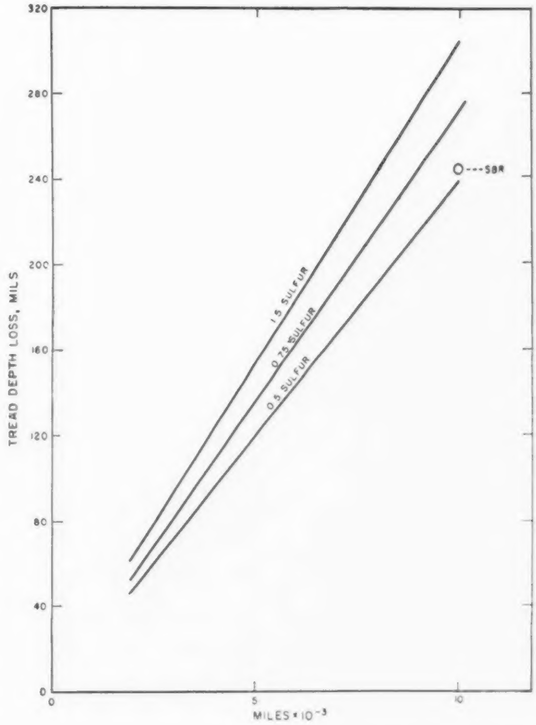


Fig. 8 Effect of reduced sulfur on butyl tread wear

TABLE 6. ROAD TEST (70 MPH.) RESULTS, BUTYL TIRES *vs.* SBR CONTROL

AVERAGE WEAR, MILES/MIL	SBR CONTROL	BUTYL 1.5S	BUTYL 0.75S	BUTYL 0.5S
FRONT	50	53	60	64
REAR	35	24	27	31
OVER-ALL	41	33	37	42
% CONTROL OVER-ALL	100	80	90	102

TEST CONDITIONS

COURSE: 70 MPH - THREE-T-FLEET, INC., MARFA, TEXAS

LOAD: 100% TRA

INFLATION: 24 PSI

TIRE CORD: 1100/2 SUPER SUPER RAYON

CORD ANGLE: 37°

TABLE 7. CONVERSION OF MILES PER MIL TO MILS (DEPTH LOSS) PER 100 MILES

SULFUR LEVEL IN TREAD	MILES / MIL	MILS/100 MILES
1.5 SULFUR	33	3.03
0.75 SULFUR	37	2.70
0.5 SULFUR	42	2.38

the effect of reduced sulfur on the wear characteristics of butyl rubber tires. A more complete breakdown of wear performance is presented in Table 6. The butyl rubber compound containing 1.5 pphr. sulfur wore only 80% as well as the SBR control. Butyl rubber tire wear was improved 12% by reducing the sulfur to 0.75 pphr. and an additional 15% by lowering the sulfur to 0.5 pphr. All test data shown here were obtained under identical conditions in a single test series. However, the same general performance ratios have been observed repeatedly in tests run over a period of several months during the period up to May, 1959.

Significance of Road Tests

Road abrasion results are affected by many factors not normally considered to be problems in determining laboratory abrasion results, notably wet road surfaces, variable ambient air and road surface temperatures, vehicle and driver characteristics, position on vehicle, aging (or reversion) as influenced by ambient and tire operating temperatures, etc. In order to control or minimize the temperature factor in road-wear testing, tires were tested only on dry pavement with all tires being on the ground and testing at the same time. Since the tests were of short duration (approximately 10,000 miles) the aging (or reversion) effect was minimized by utilizing a fast-wear route, thus keeping the time heat history at a minimum.

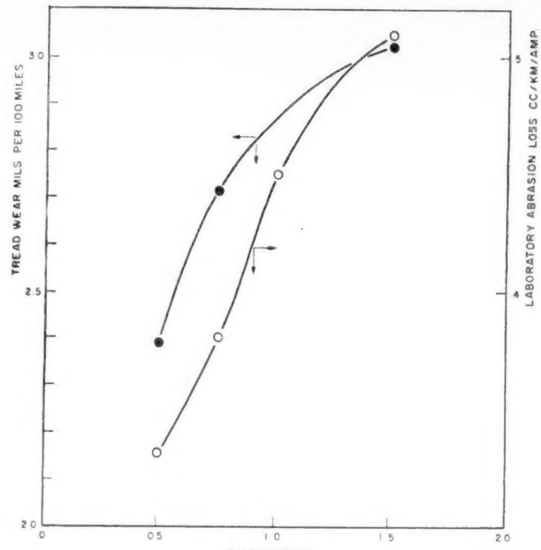


Fig. 9. Comparison of road (solid circles) and laboratory (open circles) abrasion tests results

Driver habit, vehicle and axle position differences were effectively controlled by rotating all tires through all vehicles and drivers in a systematic and controlled fashion. Speed (average and maximum) was controlled by establishing a strict driving routine, which, in turn, was controlled by the use of hidden recording tachographs. By minimizing or controlling the effects of the above-mentioned variables it is possible to duplicate road wear results at different times in much the same manner that laboratory results may be duplicated by the exact control of all variables. Thus road-wear data developed under these conditions assume greater stature and are more reliable than data from tests where the variables are not or cannot be controlled.

Comparison of Laboratory and Road Abrasion

A comparison of road wear abrasion and laboratory abrasion is presented in Figure 9. In order to place both these wear tests on the same basis, the road wear values, originally given in miles per mil, have been converted to a *loss* in *tread depth per unit distance* run. Table 7 lists the comparative values.

Our laboratory abrasion results have been expressed as a volume loss of material per distance run per unit of braking energy. By changing miles per mil to the reciprocal based upon a unit distance of 100 miles, the two types of wear ratings are placed on a comparable basis.

In Figure 9 the effect of sulfur level in the tread cap on road-wear abrasion is described by the solid circles and read from the left-hand ordinate. The corresponding effect of sulfur level in the tread cap on laboratory abrasion is described by the hollow circles

APPENDIX TABLE 1. GRAECO-LATIN SQUARE 4 x 4, FOUR INGREDIENTS AT FOUR LEVELS

Sulfur, pphr	Oil (Necton 60), pphr	Elastopar, pphr	SAF Black, pphr
$S_1 = 0.5$	$N_1 = 0$	$E_1 = 0$	$B_1 = 30$
$S_2 = 0.75$	$N_2 = 5$	$E_2 = 0.5$	$B_2 = 40$
$S_3 = 1.00$	$N_3 = 10$	$E_3 = 1.0$	$B_3 = 50$
$S_4 = 1.50$	$N_4 = 15$	$E_4 = 1.5$	$B_4 = 60$

	S_1	S_2	S_3	S_4
N_1	.27 (E_1B_1)	.32 (E_2B_2)	.48 (E_3B_3)	.67 (E_4B_4)
N_2	.41 (E_2B_4)	.39 (E_1B_3)	.47 (E_4B_2)	.46 (E_3B_1)
N_3	.31 (E_3B_2)	.40 (E_4B_1)	.45 (E_1B_4)	.47 (E_2B_3)
N_4	.31 (E_4B_3)	.42 (E_3B_4)	.40 (E_2B_1)	.42 (E_1B_2)

S	N	B	E
(S_1) 1.30	(N_1) 1.74	(B_1) 1.53	(E_1) 1.53
(S_2) 1.53	(N_2) 1.73	(B_2) 1.52	(E_2) 1.60
(S_3) 1.80	(N_3) 1.63	(B_3) 1.65	(E_3) 1.67
(S_4) 2.02	(N_4) 1.55	(B_4) 1.95	(E_4) 1.85
6.65	6.65	6.65	6.65

and read from the right-hand ordinate. The general patterns of both curves are similar, visually indicating the extent to which road-wear results follow the directions of the statistical compounding experiments.

Summary and Conclusions

The study of the effect of compounding variables on the road wear of experimental butyl tires was facilitated by statistically designed laboratory compounding experiments. Because rubber compounds possess many variables, orthodox experiments which attempt to study one variable at a time result in an unwieldy number of experiments. When attempts are made to coordinate expensive road-wear tests with orthodox experiments, financial burdens may become excessive. However, if a certain variable asserts itself with statistical significance, in a simple designed experiment, limited road-wear tests based upon these directions can be coordinated with laboratory experiments.

In these studies devoted to abrasion resistance and road wear, four ingredients of a tread compound were varied according to a Graeco-Latin Square design. The effect of these ingredient variations upon laboratory abrasion resistance was observed, using a Lambourn abrader. From these experiments using one molecular weight level of butyl rubber (Enjay Butyl 218), it was concluded that:

1. The most significant improvement in abrasion resistance could be obtained by reducing the sulfur content of the formulation. Reduction in sulfur level from 1.5-parts to 0.5-part per 100 parts of polymer resulted in a 35% reduction in *abrasion losses.*

2. To a less significant degree, reduction in carbon black content from 60 to 40 parts of SAF black per 100 parts of polymer resulted in lower abrasion losses. Further reduction to 30 parts of SAF black produced no further reduction in abrasion losses.

3. Variations in oil plasticizer content, and Elastopar, heat promoter, produced much less significant effects.

Butyl tires of the same tread design and construction were then produced and tested for road wear at 70 miles per hour. Compounds following the dictates of the designed experiment indicated a *road life improvement* of 30% as the sulfur content was lowered from 1.5 parts to 0.75- to 0.5-part per 100 of polymer. In general, these compound changes that produced the improved road life formed softer and more extensible vulcanizates.

APPENDIX

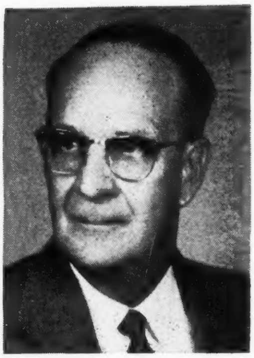
Analysis of the Significance of the Abrasion Data

The following steps are outlined to illustrate the mechanics of analyzing the data. The complete set of data is presented in Appendix Table 1, wherein the Graeco-Latin Square design is repeated with the complete summation of all variable ingredient effects. Calculation steps are best carried

(*Continued on page 684*)

Gel Formation in Styrene-Butadiene Rubbers[1]

By C. A. CARLTON
J. M. Huber Corp., Borger, Tex.



C. A. Carlton

CUT growth of styrene-butadiene rubber tire tread compounds has been a serious problem since the inception of the synthetic rubber industry. White[2] and his coworkers have shown that the presence of high molecular weight "tight" gel in SBR has an adverse effect on the processing properties of unvulcanized compounds and on the properties of the vulcanizate, giving increased modulus, decreased tensile strength, and decreased resistance to cut growth.

The study reported in this paper was undertaken to determine the effect of processing conditions and the effect of various compounding ingredients on the formation of gel in SBR and also to determine the effect of gel on the physical properties of unvulcanized and vulcanized SBR compounds, with particular reference to tire tread cut growth as determined by laboratory flex cracking tests.

Experimental Procedure

Unless otherwise specified, a batch size of 900 grams was used in a size B laboratory Banbury for these experiments. The Banbury was preheated first to 350° F. with a "cleanout" batch. Using No. 3 speed (front rotor, 160 rpm.; back rotor, 142 rpm.), batches were mixed 12 minutes, with the temperature regulated at 340-350° F. by circulating cold water in the jacket and rotors of the Banbury.

The procedure of Medalia and Kolthoff[3] was used for making the gel determination on the original mix and on a cold mill remix. The "cold milled" samples were prepared by passing a 20-gram portion three times through a cold laboratory mill with a roll clearance of 1/32-inch. The gel remaining after such cold milling is considered to be "tight" gel.

For most of the experiments a single lot of SBR 1500 was used for studying the effects of processing procedures and compounding ingredients. This lot of SBR 1500 was stabilized with BLE[4] antioxidant.

Effect of Mastication Temperature

In order to determine the effect of mastication temperature on gel formation, batches of SBR 1500 were masticated at temperatures from 225 to 375° F. in 25° F. increments, and the data obtained are shown in Table 1, including the Mooney viscosity of the original mix. Gel formation was found to start at 325° F., but the gel formed at this temperature disappeared on cold milling. The gel formed at 350° F. was reduced slightly by cold milling; whereas that formed at 375° F. was not affected.

TABLE 1. MASTICATION TEMPERATURE AND TYPE AND AMOUNT OF GEL FORMED IN SBR 1500

	% Gel		
Mastication Temperature, °F.	After Original Mix	Plus Cold Milling	Mooney Viscosity*
225	0	0	43
250	0	0	44
275	0	0	43
300	0	0	45
325	23	0	48
350	34	30	54
375	41	40	42

* ML—4 min. @ 212° F. Mooney viscosity of unmasticated SBR 1500 was 45.

Effect of Mastication Time at 350° F.

The effect of time of mastication at 350° F. on gel formation was determined by running batches of SBR 1500 in the Banbury for periods of 3, 6, 9, and 12 minutes. The gel content increased as time of mastication was increased. The gel content after 6 minutes of mastication disappeared on cold milling; while that formed during the longer cycles was found to be mostly "tight" gel, as shown in Table 2. The Mooney viscosity

TABLE 2. MASTICATION TIME AT 350° F. AND TYPE AND AMOUNT OF GEL FORMED IN SBR 1500

	% Gel		
Mastication Time, Min.	After Original Mix	Plus Cold Milling	Mooney Viscosity*
3	0	0	55
6	12	0	52
9	25	20	47
12	34	30	46

* ML—4 min. @ 212° F.

[1] Presented before the Division of Rubber Chemistry, ACS, Los Angeles, Calif., May 15, 1959.
[2] *Ind. Eng. Chem.*, 37, 8, 770 (1945).
[3] *J. Polymer Sci.*, 6, 4, 433 (1951).
[4] Diphenylamine-acetone reaction product, Naugatuck Chemical Division, United States Rubber Co., Naugatuck, Conn.

Gel Formation in Styrene-Butadiene Rubbers

The presence of gel in SBR has an adverse effect not only on the processing of unvulcanized compounds, but on the physical properties of the vulcanizate, including the resistance to flex cracking of SBR-HAF black tire tread compounds.

The amount and the type of gel formed in SBR, when masticated alone in a Banbury, has been found to be dependent on both time and temperature. Gel formation becomes noticeable between 325 and 350° F., and a significant amount of "tight" gel is formed in nine minutes at 350° F.

When SBR is masticated alone in the presence of certain accelerators, antioxidants, antiozonants, plasticizers, etc., some of these compounding ingredients have a marked effect on type and amount of gel formed. Some inhibit gel formation; while others promote gel formation.

Heat alone, in the absence of oxygen and mechanical working, produce very little gel in unmasticated and unpigmented SBR. At certain levels of heat, mechanical working, and oxygen, however, gel formation takes place.

In the presence of HAF black, gel-free SBR mixed under conditions to prevent further gel formation, develops significant amounts of insoluble rubber. Gel-containing SBR mixed with HAF black develops an amount of insoluble rubber that is greater than when gel-free SBR is used, but is less than the sum of the gel content before adding black and the amount of rubber insolubilized by black added to gel-free SBR.

Including a gel-inhibiting antioxidant or antiozonant in the SBR does not provide the same resistance to flex cracking as a reduction of mastication temperature and time.

of the original mix decreased with increase in time of mastication.

Various SBR's Compared

One sample of each of the available brands of SBR 1500 from 10 different producers was masticated for 12 minutes at 350° F. and tested for gel content in the original mix only. As shown in Table 3, five samples gave gel contents in the 25% range; three in the 35% range; one had 45% gel; and one formed no gel. These differences may be due to the differences in the effectiveness of the various stabilizers used in the various rubbers in preventing gel formation. The Mooney viscosities of the samples both as received and after mastication are shown also in Table 3.

The data in Table 4 show a comparison of various grades of SBR's which had been coagulated by procedures other than the conventional salt-acid method in the course of their manufacture. SBR Nos. 1004, 1010, 1013, and 3110 are alum coagulated; 1014 is brine-alum coagulated, and the balance are coagulated by the glue-acid method. Again, Mooney viscosity as received and after mastication are reported.

Effect of Compounding Ingredients on Gel Formation

Accelerators

Various accelerators at a concentration of one part per 100 parts of SBR 1500 were compared for their effect on gel formation and Mooney viscosity after 12 minutes' mastication at 350° F. The data are presented in Table 5.

Tetramethyl thiuram monosulfide prevented gel formation and produced the lowest Mooney viscosity of

TABLE 3. GEL CONTENT AND MOONEY VISCOSITY OF 10 PRODUCERS' SBR 1500

Producer Number	% Gel*	Mooney Viscosity†	
		As Received	Masticated
1	28	50	46
2	35	49	45
3	24	47	43
4	35	51	46
5	25	53	54
6	0	51	39
7	25	53	45
8	45	57	41
9	25	50	45
10	35	50	41

TABLE 4. SBR COAGULANT PROCEDURE AND GEL CONTENT

SBR No.	Coagulant	% Gel*	Mooney Viscosity†	
			As Received	Masticated
1004	AL	35	55	34
1007	GA	28	37	20
1010	AL	41	31	22
1013	AL	27	33	23
1014	BAL	33	65	23
1016	GA	38	55	21
1019	GA	35	59	31
1022	GA	35	80	43
1023	GA	32	52	18
1503	GA	44	50	37
1708	GA	10	52	17
3110	AL	1	27	21

* % Gel, after 12 min. @ 350° F., original mix.
† ML—4 min. @ 212° F.

TABLE 5. ACCELERATORS AND % GEL IN SBR 1500

Accelerator	% Gel After Orig. Mix	% Gel Plus Cold Milling	Mooney Viscosity*
None	40	37	45
Diphenylguanidine†	18	0	47
Benzothiazyl disulfide‡	43	43	46
Oxydiethylene benzothiazole 2-sulfenamide§	25	20	56
N-cyclohexyl-2-benzothiazole sulfenamide¶	47	45	60
Tetramethyl thiuram monosulfide‖	0	0	37

* ML—4 min. @ 212° F.
† American Cyanamid Co., rubber chemicals department, Bound Brook, N. J.
‡ American Cyanamid.
§ NOBS Special, American Cyanamid.
¶ Santocure, Monsanto, rubber chemicals department.
‖ Thionex, E. I. du Pont de Nemours & Co., Inc., elastomer chemicals department, Wilmington, Del.

TABLE 6. ANTIOXIDANTS AND % GEL IN SBR 1500

Antioxidant	% Gel After Orig. Mix	% Gel Plus Cold Milling	Mooney Viscosity*
None	40	37	39
AgeRite Alba†	37	31	49
Stalite‡	31	30	41
Antioxidant 2246§	0	0	29
BLE-25¶	24	0	37
Powder‖	9	0	45
Neozone D**	37	27	41
Permalus*†	0	0	36
Polygard*‡	0	0	25
Santovar A*§	0	0	22
Santowhite Crystals††	24	0	34
L†*	42	41	36
MK†‡	40	29	40
Stabilite†§	0	0	30
Alba‡*	24	7	56
Styphen 1‡†	44	46	36

*ML—4 min. @ 212° F.
† Hydroquinone monobenzyl ether, R. T. Vanderbilt Co., New York, N. Y.
‡ Octylated diphenylamines, R. T. Vanderbilt.
§ 2,2'-Methylene-bis(4-methyl-6-tertiary butyl phenol), American Cyanamid, rubber chemicals department.
¶ Acetone and diphenylamine reaction product, Naugatuck Chemical.
‖ Diarylamine-ketone-aldehyde reaction product, 65%; N, N'-diphenyl-p-phenylene diamine, 35%; Naugatuck Chemical.
** Phenyl-beta-naphthylamine, Du Pont elastomer chemicals department.
*† Di-ortho-tolyl guanidine salt of dicatechol borate, Du Pont elastomer chemicals department.
*‡ Tri(nonylated phenyl) phosphites, Naugatuck Chemical.
*§2,5-Di-(tertiary amyl) hydroquinone, Monsanto rubber chemicals department.
†† 4,4'-Thio-bis(6-tertiary butyl-m-cresol), Monsanto rubber chemicals department.
†* Thio-bis-(di-secondary amyl phenol), Monsanto rubber chemicals department.
†‡ 6-Tertiary butyl-m-cresol and SCl_2 reaction product, Monsanto rubber chemicals department.
†§N, N'-diphenylethylene diamine, C. P. Hall Co., Akron.
‡* N, N'-di-ortho-tolyl ethylene diamine, C. P. Hall.
‡† Tri-alpha-methyl benzyl phenol, Dow Chemical Co., Midland, Mich.

the five accelerators tested. Diphenylguanidine produced an intermediate amount of gel during the original mixing which disappeared on cold milling. The other accelerators produced "tight" gel, two of which gave higher gel content than the SBR 1500 control.

Antioxidants

A number of antioxidants at a concentration of one part per 100 parts of SBR 1500 were compared for their effect on gel formation and Mooney viscosity after 12 minutes' mastication at 350° F. The data are presented in Table 6.

Some antioxidants are effective in preventing gel formation under the conditions of this experiment; while others are quite ineffective.

Antiozonants

Six antiozonants were compared at a concentration of one part per 100 parts of SBR 1500 for gel formation after the 12 minutes' mastication at 350° F. Five of the six antiozonants were derivatives of para-phenylene diamine, as follows: (1) N, N'-di-(l-methylhepty);[5] (2) N, N'-di-(1-ethyl-3-methyl pentyl);[6] (3) N, N'-dimethyl-N,N'-di-(l-methyl propyl);[7] (4) N-cyclohexyl-N'-phenyl;[8] (5) a mixture of diaryl-p-phenylene diamines.[9] The sixth antiozonant tested was 6-ethoxy-2,2,4-trimethyl-1,2-dihydroquinoline.[10]

All of the p-phenylene diamine derivatives completely prevented gel formation under the conditions of the test. The dihydroquinoline derivative proved to be a gel promoter, giving 56% in the original mix and 53% after cold milling, as compared with 40 and 37%, respectively, for the control.

[5] UOP 288, Universal Oil Products Co., Des Plaines, Ill.
[6] UOP 88, Universal Oil Products Co.
[7] Eastozone 32, Eastman Chemical Products, Inc., Kingsport, Tenn.
[8] Flexzone 6H, Naugatuck Chemical.
[9] Wing-Stay 100, Goodyear Tire & Rubber Co., chemical division, Akron, O.
[10] Monsanto Chemical Co., rubber chemicals department, Akron.

TABLE 7. PARA-PHENYLENE DIAMINE DERIVATIVES AND % GEL IN SBR 1500

Parts Antiozonant	% Gel After Original Mix	% Gel Plus Cold Milling
1.00	0	0
0.75	0	0
0.50	0–3	0
0.25	7–19	0–4

A series of concentrations of each of the above p-phenylene diamine derivatives was then tested. At a concentration of 0.75-part per 100 of SBR 1500, all completely prevented gel formation; while at 0.50-part only very small amounts of gel were found in the original mix, all of which disappeared on cold milling. The data in Table 7 show the minimum and maximum amounts of gel formed at the four concentrations tested and indicate that all of these p-phenylene diamine

TABLE 8. CHEMICAL PLASTICIZERS AND % GEL IN SBR 1500 PLASTICIZER

Plasticizer	% Gel After Original Mix	% Gel Plus Cold Milling	Mooney Viscosity*
None	40	37	45
JMH†	0	0	22
Pepton 22‡	48	52	50
RPA #2§	51	54	40

* ML—4 min. @ 212° F.
† Alpha nitroso-beta-naphthol (not on market), J. M. Huber Corp.
‡ 2,2'-Dibenzamido diphenyl disulfide, American Cyanamid rubber chemicals department.
§ Naphthyl-beta-mercaptan, 33%; inert materials, 67%; Du Pont elastomer chemicals department.

TABLE 9. PHYSICAL PLASTICIZERS AND % GEL IN SBR 1500

Plasticizer	% Gel After Original Mix	% Gel Plus Cold Milling	Mooney Viscosity*
None	40	37	45
Sundex 53†	21	15	35
Cumar MH 2½‡	17	5	35
Califlux TT§	18	0	38
Dutrex 20¶	19	17	36
Philrich 5‖	26	26	36
Circosol 2XH**	18	17	37

* ML—4 min. @ 212° F.
† Aromatic oil, Sun Oil Co., Philadelphia, Pa.
‡ Coumarone indene resin, Plastics & Coal Chemical Division, Allied Chemical Corp., New York.
§ Highly aromatic oil, Golden Bear Oil Co., Bakersfield, Calif.
¶ Highly aromatic oil, Shell Oil Co., New York.
‖ Highly aromatic oil, Phillips Chemical Co., Akron.
** Naphthenic oil, Sun Oil.

TABLE 10. RETARDERS AND % GEL IN SBR 1500

Retarder	% Gel After Original Mix	% Gel Plus Cold Milling	Mooney Viscosity*
None	40	37	45
Vultrol†	33	32	58
Retarder PD‡	33	32	57
W§	21	12	46

* ML—4 min. @ 212° F.
† N-nitroso diphenylamine, B. F. Goodrich Chemical Co., Cleveland, O.
‡ Phthalic anhydride, American Cyanamid Co.
§ Salicylic acid, Du Pont elastomer chemicals department.

derivatives are very effective gel inhibitors, even at low concentrations.

Chemical Plasticizers

Three chemical plasticizers at the concentration of one part per 100 parts of SBR 1500 were compared

TABLE 11. TACKIFIERS AND % GEL IN SBR 1500

Tackifier	% Gel After Original Mix	% Gel Plus Cold Milling
None	40	37
Butac*	16	0
Natac*	17	0
Turgum S†	27	0
Staybelite‡	27	23

* Amine treated rosin, J. M. Huber Corp.
† Rosin-terpene blend, J. M. Huber Corp.
‡ Hydrogenated rosin, Hercules Powder Co., Wilmington.

under the usual test conditions. Alpha-nitroso-beta-naphthol completely inhibited gel formation; while the others were ineffective. The data are shown in Table 8.

Physical Plasticizers

Five samples of oils used in extending SBR and one sample of coumarone indene resin were compared at a concentration of 7.5 parts per 100 of SBR 1500 for their effect on gel formation and Mooney viscosity after mastication for 12 minutes at 350° F. In general, the oils reduce the amount of gel formed, particularly the "tight" gel. Some oils are more effective than others. The data obtained as shown in Table 9.

Retarders

Three retarders at one part per 100 of SBR were compared for gel formation and Mooney viscosity. Salicylic acid reduces gel formation, particularly "tight" gel; while all three increase Mooney viscosity. The data are shown in Table 10.

Tackifiers

Four modified rosin acid products at a concentration of 5 parts per 100 of SBR were compared. As shown by the data in Table 11, all three products effectively prevent the formation of "tight" gel since the gel formed disappeared on cold milling. Hydrogenated rosin permitted the formation of a substantial amount of "tight" gel, but less than that of the control mix.

Role of Oxygen in Gel Formation

Hagen[11] states that "in the dry polymer, gelation becomes appreciable at temperatures above 250° F. and that the presence of a small amount of oxygen catalyzes the reaction."

E. I. du Pont de Nemours & Co., Inc.,[12] has shown that 14% gel is formed when SBR 1500 is masticated for 12 minutes at 300° F. on an open mill. We obtained no gel when SBR 1500 was masticated in a Banbury under these conditions of time and temperature.

Bell[13] states that "mill mixed polymers gel faster

[11] H. Hagen, India RUBBER WORLD, 108, 1, 45 (1943).
[12] "News about Du Pont Elastomers and Chemicals," (Sept., 1958).
[13] R. W. Bell, Du Pont elastomer chemicals laboratory, private communication (Nov. 13, 1958).

Table 12. Heat, Oxygen, Mastication and % Gel in SBR 1500

Conditions	% Gel
Masticated 12 min., 350° F.	44.0
O_2 excluded, heated 15 min., 350° F.	2.5
96 Min., 296° F.	0.9

Table 13. Heat and % Insoluble Rubber in SBR 1500-HAF Black Mix

Conditions	% Total Insoluble Rubber
Original mix	29
Remix	29
O_2 excluded, heated, 15 min., 350° F.	35

than when Banbury mixed, probably due to the greater availability of oxygen during mill mixing." In order to throw more light on this subject, the effect of heat alone in the absence of both oxygen and mechanical work was investigated.

A sample of unmasticated SBR 1500 was cold pressed over night in an aluminum mold with aluminum foil on each side of the test piece. The mold was removed from the press; the empty press was heated at 350° F.; the mold was then reinserted into the press, and the test piece was heated for 15 minutes at 350° F. A repeat test was run using a heating period of 96 minutes at 296° F. Also, a batch of the same SBR 1500 was masticated in the Banbury for 12 minutes at 350° F. All samples were tested for gel content, with the results shown in Table 12. These results demonstrate that under the conditions of this experiment, heat alone produces very little gel; while heat and mechanical work and oxygen do.

An experiment similar to the one described in the preceding paragraph was performed with a mixture of 100 parts of SBR 1500 and 50 parts of HAF black to determine the effect of heat alone in the absence of oxygen and mechanical work (except for that involved in making the SBR-HAF black mix) on the total amount of insolubilized rubber[3] formed.

The mix was made in a size B Banbury using a batch size of 1000 ml., an 8-minute cycle, No. 1 speed (front rotor, 80 rpm.; back rotor, 71 rpm.), and cooling water in the jacket and rotors on full in order to keep the temperature of the batch below that at which gel would form. After aging 24 hours, the batch was remixed in the Banbury under the same conditions as before except that the time was four minutes and the batch was dumped at 288° F. A sample from the remixed batch was cold pressed over night to remove completely any trapped air, then heated in the mold for 15 minutes at 350° F. and cooled to room temperature by passing cold water through the press platens. Insoluble rubber was determined on samples taken after all three operations, with the results shown in Table 13.

Heat alone in the absence of oxygen and mechanical work increased the percentage of insoluble rubber from 29 to 35, which is a significant change. Please note that remixing of the original mix did not change the insoluble rubber content. Since heat alone in the absence of oxygen and mechanical work formed only a trace of gel in SBR in the absence of carbon black, as shown in Table 12, it can be concluded that the increase in insoluble rubber in the presence of carbon black is due to further binding of rubber by the carbon black by heat alone. We know of no way to separate insoluble gel rubber from rubber that is bound by and made insoluble by carbon black; therefore we prefer the term "total insoluble rubber" to the term "bound rubber" in rubber-pigment mixes.

Stickney[14] and his coworkers have presented evidence to indicate that HAF blacks delay gel formation and that heat alone does increase the amount of insoluble rubber in a rubber-carbon black mix.

Effect of Gel in SBR on Total Insoluble Rubber in SBR-Black Mix

In an attempt to determine the effect of gel in premasticated SBR 1500 on the total insoluble rubber that would be found in an SBR 1500-HAF black mix made from such gel-containing rubber, the following experiment was performed.

Two SBR 1500-HAF black mixes, both containing 42.5 parts of HAF black, were prepared. Compound A was made from unmasticated SBR 1500; while compound B was made from SBR 1500 that had been premasticated for 12 minutes at 375° F. Both compounds were mixed in the size B Banbury, using a 1000-ml. batch, an 8-minute cycle, No. 1 speed, and cooling water on full in the jacket and rotors to keep the dump temper-

[14] *Rubber Chem. Tech.*, 31, 369 (1958).

Table 14. Gel Content of SBR and % Insoluble Rubber in SBR-HAF Black Mix

Conditions	% Gel	% Insoluble Rubber	Banbury Dump Temperature, °F.
Unmasticated SBR 1500	0	—	—
Premasticated SBR 1500	35	—	—
Final Mix A	—	19	300
B	—	43	290

Table 15. Mastication Temperature and % Insoluble Rubber

Conditions	% Total Insoluble Rubber	Mooney Viscosity*
12 mins. @ 300° F.	28	76
360° F.	36	81
5 mins. @ 375° F.	30	96

* ML—4 min. @ 212° F.

ature at 300° F. or below to prevent further gel formation in the SBR.

The gel content of the two samples of SBR 1500 and the total insoluble rubber content of the SBR 1500-HAF black compounds A and B are given in Table 14. It is obvious from these data that when reinforcing carbon black is added to an SBR that contains a "tight" gel (formed by hot premastication of SBR alone), the total insoluble rubber in the compound (43%) is much greater than when no gel is present in the SBR before the carbon black is added to the compound (19%). The total insoluble rubber in the compound made from the gel-containing rubber is not so great, however, as the sum of the gel content before adding the black and the amount of rubber insolubilized by the carbon black added to SBR containing no gel (35% + 19% = 54%; gel content in premasticated SBR 1500 plus insoluble rubber in Final Mix A). These results would seem to indicate that a portion of the gel has been joined with the carbon black in Mix B.

Effect of Mastication Temperature on Total Insoluble Rubber in SBR-Black Mix

A composition containing 100 parts of SBR 1500 and 50 parts of HAF black was mixed in the Banbury for varying periods of time and at various temperatures. The data in Table 15 show that the total insoluble rubber increases with the increase in mixing temperature, with the same mixing time. Also, a five-minute mix at 375° F. gives about the same amount of insoluble rubber as is obtained in 12 minutes at a temperature of 300° F.

It will be noted that the Mooney viscosity of the batches does not correlate with the % insoluble rubber. The mix made in five minutes at 375° F. is much stiffer than the mix made in 12 minutes at 300° F.; yet the two mixes are substantially equal as regards insoluble rubber content. Repeated tests have shown that the maximum amount of SBR 1500 that is insolubilized by 50 parts of HAF black is in the range of 35%.

TABLE 16. PREMASTICATION TEMPERATURE AND PHYSICAL PROPERTIES OF TREAD VULCANIZATES

Premastication Temp., °F., SBR 1500	Physical Properties SBR 1500-HAF Black Stock: Modulus, 200% Elong.*	Tensile Strength, psi.	De Mattia Flexing†
Unmasticated	990	4000	48,000
225	1030	4320	39,000
250	1040	4230	35,000
275	1060	4120	34,000
300	1130	4040	25,000
325	1410	3980	7,000
350	1700	3640	4,500
375	1740	3300	3,500

* Cured 60 min. @ 300° F.
† Flexes to crack one inch. ASTM D 813-57T, American Society for Testing Materials, Philadelphia, Pa.

Effect of Premastication Temperature on Gel Formation and on Physical Properties of SBR-HAF Black Tread Compound

The SBR 1500, which was premasticated for 12 minutes at various temperatures to obtain the gel data presented in Table 1, was made into tread compounds according to the following recipe:

SBR 1500	100.0
HAF black	42.5
Zinc oxide	5.0
Stearic acid	1.5
Sulfur	1.8
Santocure	1.0

The tread compounds were mixed in the Banbury on an 8-minute cycle, at the No. 1 speed, and with the cooling water on full to keep the temperature of the batch below 300° F. so that no further gel would form. The sulfur and Santocure were added on a 6- by 12-inch laboratory mill. The vulcanizates were tested for tensile strength, modulus at 200% elongation, and De Mattia flexing, and the results are presented in Table 16.

Modulus increased slightly with increase in temperature of premastication of the SBR 1500, up to and including 300° F., after which it increased rapidly. Tensile strength was highest with the rubber that had been premasticated at 225° F. and then decreased with increase in premastication temperature; the decrease becomes substantial at premastication temperatures of 350-375° F.

Resistance to flex cracking was best with the unmasticated control and decreased with increase in premastication temperature. A very sharp decrease in resistance to flex cracking occurred at a premastication temperature of 325° F., in spite of the fact that the "loose" gel formed at this temperature (see Table 1) is of the type that is destroyed by cold milling.

Effect of Gel Inhibitor on Tread Compound

In order to determine the effect of gel inhibitor on the flex cracking of an SBR 1500-HAF black tire tread compound, three such compounds, A, B, and C, were mixed under the same conditions as in the preceding section and according to the following formulation:

SBR 1500	100.0
HAF black	50.0
Zinc oxide	5.0
Stearic acid	1.5
Circosol 2XH	7.5
Santocure	1.0
Sulfur	1.8

Compound A was made from unmasticated SBR 1500; compound B from SBR 1500 which had been premasticated 12 minutes at 350° F.; and compound C from SBR 1500 which had been premasticated 12 minutes at 350° F. and contained one part of a gel inhibiting antioxidant. The SBR 1500 in compounds A and C were entirely free from gel; while the SBR 1500 used in compound B contained 38% of a "tight" gel.

From the results reported in Table 17, it can be seen

TABLE 17. EFFECT OF GEL INHIBITOR ON FLEX CRACKING OF SBR-HAF BLACK TREAD

		Physical Properties SBR-HAF Vulcanizate		
Compound	% Gel in SBR 1500	Modulus, 200% Elong.	Tensile Strength, psi.	De Mattia Flexing
A	0	900	3730	62,000
B	38	1540	3020	2,200
C	0	1000	3410	23,000

that compound B, which contained a substantial amount of "tight" gel, gave high modulus, low tensile strength, and extremely poor resistance to flex cracking. Compound C, in which the SBR 1500 had been premasticated in the presence of a gel inhibitor, is far superior to compound B, but is decidedly inferior to control compound A, particularly in flex-cracking resistance.

It is not to be inferred from the data presented that materials which effectively prevent gel formation in SBR in the absence of pigmentation will function in a similar manner in the presence of reinforcing pigments such as finely divided reinforcing carbon blacks.

Summary and Conclusions

The amount and the type of gel formed in SBR, when masticated alone in a size B Banbury, have been found to be dependent on both time and temperature. With a 12-minute mastication at 325° F., "loose" gel is formed; at 350° F. a substantial quantity of "tight" gel is formed. At 350° F., "loose" gel is formed in six minutes, and a substantial amount of "tight" gel in nine.

When SBR is masticated alone in the presence of each of certain accelerators, antioxidants, antiozonants, chemical plasticizers, physical plasticizers, retarders, and tackifiers, some of these compounding ingredients have a marked influence on the type and the amount of gel formed. Some inhibit gel formation; while others are gel promoters. Antiozonants that are derivatives of para phenylene diamine, even at low concentrations on the SBR, effectively prevent gel formation.

Heat alone, in the absence of oxygen and mechanical working, produces very little gel in unmasticated and unpigmented SBR, but at certain levels of heat, mechanical working, and oxygen, gel formation becomes significant.

In the presence of reinforcing carbon black, SBR which contains no gel and is mixed under conditions found to prevent gel formation in the SBR alone, develops significant amounts of insoluble rubber. When the SBR does contain gel before mixing with the carbon black, the amount of insoluble rubber formed is greater than when gel-free SBR is used, but is less than the sum of the original gel and the insoluble rubber produced from gel-free SBR on mixing with carbon black.

The presence of even "loose" gel in SBR has an adverse effect on the physical properties of SBR-HAF black tread compounds, particularly as regards flex cracking and cut growth. Including a gel inhibiting antioxidant or antiozonant in the SBR does not provide the same resistance to flex cracking as reduced mastication and temperature in the preparation of SBR-HAF black tread compounds.

Butyl Tire Tread Abrasion

(*Continued from page 677*)

out with the aid of a calculating machine.

STEPS:

1. Sum up the effect of each level of each ingredient upon abrasion loss (Table 2). For example, the sum of the effects of compounds containing just S_1 is 1.30; for just B_3 the sum of the effects is 1.65. As a check on the additions, the *sum* of the *sums* should all be equivalent as shown by the value 6.65.

2. Determine the sum of the squares due to all factors. (Note in order to eliminate small decimal values upon squaring, the fractional abrasion values were coded by multiplying each original value by 100. This is a sum of the squares of each individual abrasion loss measurement in the 16 boxes of the design. Total sum of squares due to all factors

$$= 27^2 + 32^2 + \ldots \text{etc.} = 28{,}957$$

3. Crude sum of squares due to sulfur level, S,

$$= \frac{130^2 + 153^2 + 180^2 + 202^2}{4} = 28{,}378$$

4. Crude sum of squares due to SAF carbon content, B,

$$= \frac{153^2 + 152^2 + 165^2 + 195^2}{4} = 27{,}941$$

5. Crude sum of squares due to Elastopar content, E,

$$= \frac{153^2 + 160^2 + 167^2 + 185^2}{4} = 27{,}781$$

6. Crude sum of squares due to oil content, N,

$$= \frac{174^2 + 173^2 + 163^2 + 155^2}{4} = 27{,}700$$

7. Correction to change the crude sum of squares to the sum of squares of the deviations from the mean,

$$\frac{665^2}{16} = 27{,}639$$

8. The number of degrees of freedom is the number of variations of any ingredient minus one.

9. The sum of the squares of the deviations from the average for each source of variance (i.e., ingredient) is found by:

Source of Variance		Sum of Squares of Deviations from the Mean (Mean Square)		
Sulfur (Step 3—Step 7)	=	28,378—27,639	=	739
SAF carbon (Step 4—Step 7)	=	27,941—27,639	=	302
Elastopar (Step 5—Step 7)	=	27,781—27,639	=	142
Oil (Necton 60) (Step 6—Step 7)	=	27,700—27,639	=	61
Residual (By difference)	=		=	74
Total (Step 2—Step 7)	=	28,957—27,639		1318

The last column of figures in Step 9 is then transferred to Table 4 (under the column headed "mean square") in the body of the paper for the determinations of the variance ratios.

The Author

Punched Cards Mechanize Job Costing Procedures

By HENRY M. HARMAN, JR., Controller
Connecticut Hard Rubber Co., New Haven, Conn.

IF YOU are a small or medium-size "custom" manufacturer of rubber products, then every time an order comes in you have one big question to answer: What should I estimate for this job?

At Connecticut Hard Rubber Co. we have found a method to answer this question quickly and accurately through a unique data processing system, which employs machines and methods tailored to our requirements by the Data Processing Division of Royal McBee Corp., Port Chester, N. Y. With 85% of our orders falling into the "special job" category, our new method of job costing allows us to make estimates that are consistently accurate and satisfactory.

The term "data processing" is too frequently associated with expensive machines and processes, but at Connecticut Hard Rubber the data processing system that we have adopted fits comfortably within our limited small-company budget. Utilizing Royal McBee's Keysort cards and a Model 360 Keysort tabulating punch, we get totals of labor and material costs and then automatically summarize these figures for an accurate picture of overall job costs. Estimates are now based on cold, hard facts rather than top-of-the-head guesses or hit-and-miss manual summaries.

Company Background

To get an idea of just how and why the data processing system is an invaluable tool in a company of our size and operation, some background information is necessary.

The Connecticut Hard Rubber Co., in New Haven, was founded almost 37 years ago to manufacture industrial hard rubber products. By 1939 we had begun work with the new synthetic rubbers and during World War II became a major supplier of gaskets, diaphragms, and custom molded parts for aircraft engine manufacturers.

In 1946, shortly after the introduction of silicone rubber, CHR became one of the first commercial fabricators of this remarkable new synthetic material. Today we are specialists in the fabrication of silicone rubber, and the aircraft industry is our principal customer. Our major products are airframe and engine seals, ducts, silicone rubber-coated fabrics, silicone rubber moldings and extrusions.

For the most part, the products we manufacture for the aircraft industry are ordered on a custom basis. Furthermore, with aircraft design moving ahead at a fantastic rate, changes in specifications of these "custom" products are far more frequent than in most other industries.

It becomes evident that compilation of job costs in an operation such as ours can be a tough chore. Labor, materials, quantities, and operations in general vary considerably from job to job. Only a highly efficient system, whereby costs can be accumulated and applied where they belong, can give us the picture we need to make accurate estimates on new jobs.

Material Cost Compilations

Our data processing system is giving us an accurate cost picture and at a price we can afford. In the determination of material costs, for example, the basic medium for collecting data is the Keysort material requisition punch-card. Each time a worker withdraws material from the storeroom, one of these requisitions is created, and the amount of material taken, its description, the job number, and other data are entered on the card. (See Figure 1.)

As the jobs progress during the day, these material requisitions are accumulated and finally sent upstairs to our processing offices, where the material withdrawals are applied against inventory records, as the first step.

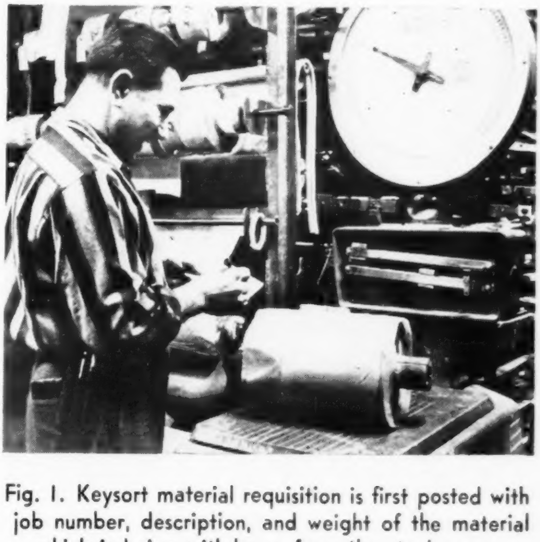


Fig. 1. Keysort material requisition is first posted with job number, description, and weight of the material which is being withdrawn from the stock room

Fig. 2. Keysort material requisition card is edge-notched with code for job number, stock number, and product class

We have killed two birds with one stone in this operation. We have handled our routine inventory work and, at the same time, created a source document for our data processing system. There is no transcribing step involved, hence, no chance of error. All that is necessary now is notching and coding the card for machine processing.

The first target in our data processing system is control, which in this case is obtained by notching the job number into every material requisition. Thus, by knowing where the material went, we know where to apply the costs.

To get the job numbers coded on the cards, we batch the requisitions according to job and notch them with the Royal McBee Electric Keypunch for job number, which includes product class as the first digit of this number, and for stock number. Figure 2 shows the operator notching the cards for these two items in the proper places around the outside edge of the cards; and Figure 3 shows one of these cards after this operation has been completed.

Each material requisition for a particular job is edge-notched with the same code number, and from a batch of cards for many jobs, those for any one job may be separated by inserting a Keysorter (a single ice-pick-type needle) into one of the marginal holes. The cards with the notched holes for the particular job number drop out of the batch when the needle is lifted.

We have put our control numbers in machine language at very little cost and with a minimum investment in time and effort. We are now ready to use the mechanized part of the system.

With each material requisition controlled through job number the next step is code punching the quantity and the price of the material on the card. To do this the Keysort requisitions are processed through the Model 360 tabulating punch, as shown in Figure 4. As the cards feed through, the operator indexes the quantity and the total cost of the material into the machine's keyboard. With this action two important operations are completed:

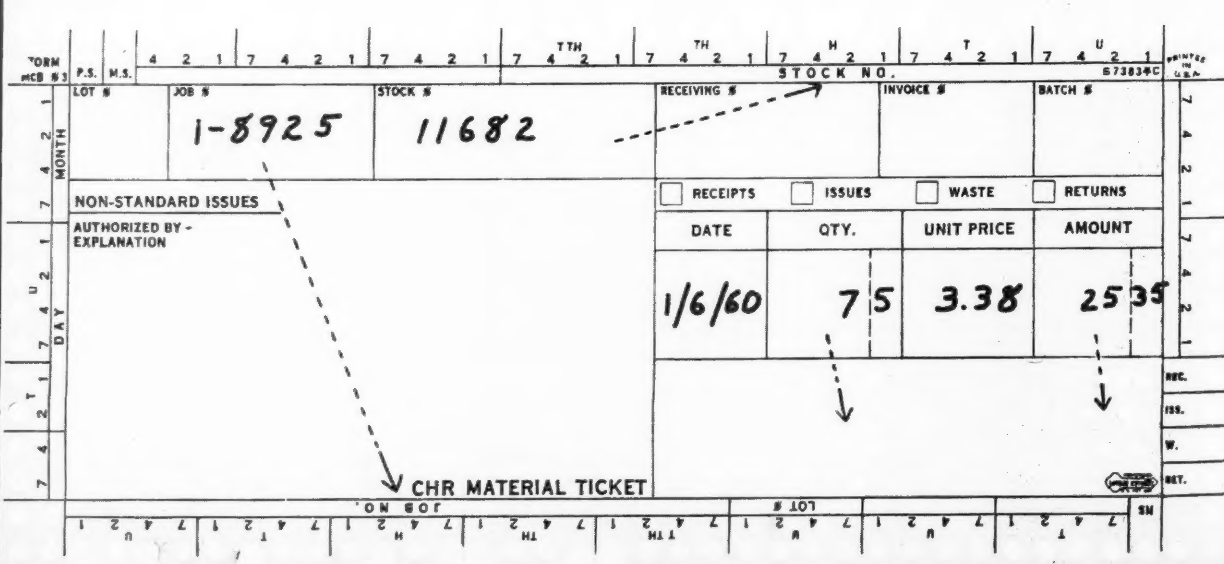
1. As the operator indexes figures into the keyboard, she creates a control tape, which shows the quantity and the value of the material issued on that day. This tape provides a proof of inventory deductions, as well as a rein on material withdrawals. We know how much was withdrawn and can judge efficiently if too much or too little material is being used.

2. This same punching action automatically puts a code into the material requisitions as shown also in Figure 3. These codes indicate, in machine language, the quantity and the dollar amount of material used.

Thus we have set up our material requisitions in such a manner that we can apply costs where they belong, with only a minimum of manual effort. When a job is completed, for example, we can go to our file of material requisitions, Keysort them by job number and run them through the tabulating punch for automatic compilation of material costs. The machine "reads" the codes punched into the cards and, without any work on the part of the operator, creates a tape showing the amounts and the total for a job.

In addition, during this same machine run we pro-

Fig. 3. Keysort material requisition after edge notch and punching quantity and price of material in body of card as described later



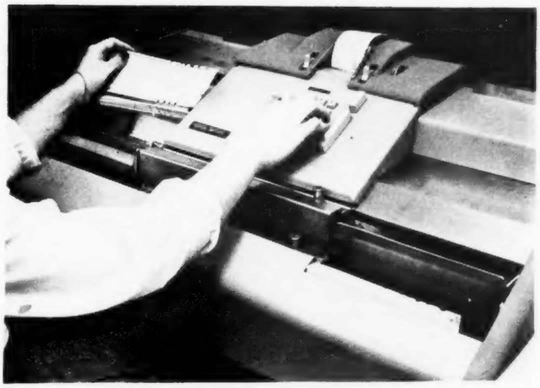


Fig. 4. With Model 360 Keysort tabulating punch, operator enters quantity and value of material on the card, and it is punch-coded in the body of the card to show these items

duce a summary or total job cost on a card, which shows the final amount of material used and its cost.

Labor Cost Compilation

The same principle applies to the accumulation of labor costs. Utilizing a Keysort labor ticket, we compile payroll data as we create the source document for our data processing system. Then, after payroll has been computed and written from these cards, we can edge-notch them for control purposes and run them through the tabulating punch for accumulating labor costs. The final result is a summary card which shows the total amount of labor cost that went into a job.

"Averaging Out" Costs

In essence, the data processing system at Connecticut Hard Rubber is built around one basic theme, that is, by putting source data on a codable and machine processable original record, we automatically accumulate job costs, efficiently, accurately, quickly, and economically. By accumulating a file of summary cards we can "average out" the labor and material cost of a particular job in order to make accurate estimates for new ones.

The idea of "averaging out" costs is particularly important to a shop working on a lot of custom jobs. Times and costs change, and we would not want to quote on a current job on the basis of costs accumulated five years ago. Yet we do want to take advantage of our history files.

In addition, with our Keysort cards and the Keysort tabulating punch we can summarize labor and material costs by department, operation, or any other factor indicated on the cards. Even if the material costs change over the years, we can tell quickly just what the average department cost has been and add this into our total cost.

Data processing, like a shoe, must fit the wearer to give the most benefits. At Connecticut Hard Rubber we have found a low-cost flexible system to fit our needs, and we are doing a far better job for management and our customers because of it.

American Latex Develops First "Space Furniture"

A "space couch" custom-molded from Stafoam urethane foamed plastic for use by Astronauts who will pilot the manned space capsules has been announced by American Latex Products Corp., Hawthorne, Calif., division of Dayton Rubber Co. The couches have been engineered to protect the Astronauts against the stresses of blastoff and descent and to insulate against the extreme temperature variations of space travel. A coating of flexible "Hypalon" is applied over the surface of the molded Stafoam.

Molded individually to each Astronaut, the couches are designed to contribute to comfort during space flight. The couches will insure equal weight distribution to best absorb the shock of acceleration during blastoff. During descent they will protect the men against the shock of parachute opening and impact of actual earth landing.

Once in orbit, the Astronaut can adjust his visual attitude by rotating the space capsule with control rockets, if necessary. The couches will contribute to the Astronaut's comfort, no matter what his "up or down" orientation in space may be.

The couches have been prepared for use in the prototype space capsules being developed by Astro Systems and Research Laboratories, Norair, Calif.

Custom-molded Stafoam "Space Couch"

Mooney Viscosity Determinations of Butyl Rubber at an Elevated Temperature

By V. B. CALHOUN; *Humble Oil & Refining Co., Baton Rouge, La.;*
R. M. MINEO; *Enjay Laboratories, Linden, N. J.;*
and J. R. REED *Humble Oil & Refining Co., Baytown, Tex.*

Mooney Viscosity on Butyl Rubber at 260° F.

Determinations of the Mooney viscosity of butyl rubber have been standardized at ML-8 minutes at 212° F. since 1942. These determinations reach a plateau at about 80 Mooney points above which high molecular weight polymers give inaccurate Mooney results.

Increased production of high molecular weight butyl rubber has made it necessary to develop a Mooney test method modified to include these polymers, and therefore be suitable for quality control.

ML-3 minutes at 260° F. is a more accurate method for use with currently produced high molecular weight butyl rubber than ML-8 minutes at 212° F. ML-8 minutes at 212° F. is still recommended for polymers below 40,000 Staudinger molecular weight since ML-3 minutes at 260° F. is inaccurate for these polymers.

THE Mooney viscometer is an instrument which measures the plasticity of elastomers by their resistance to shear. Essentially, the instrument is a closed cavity of fixed dimensions which contains a rotating serrated disk. The instrument is provided with temperature controls. Resistance of the polymer in the cavity to shear at a given temperature is measured by thrust against the worm gear which drives the serrated disk and is recorded as Mooney points.[1]

The viscometer has been used as a measure of the plasticity of synthetic rubbers since 1942, when it was adopted for use in government rubber plants. Early in its use as a production control instrument, operating conditions were standardized so that values might be comparable throughout the rubber industry. Conditions chosen for butyl rubber were eight minutes shearing time with a large rotor at an operating temperature of 212° F. (noted ML-8 minutes at 212° F.). A limitation of these conditions in their application to the production of butyl rubber (IIR) is responsible for the investigation reported here.

Difficulties at 212° F.

Mooney viscosity determinations of butyl rubber reach an upper limit of about 80 points at 212° F. despite increasing molecular weights of the elastomers under test as determined from the viscosity of dilute solutions. Below this limit, Mooney viscosity correlates with Staudinger molecular weight[2] to within about ±2 Mooney points. (Such variation as exists is produced by the combined experimental errors of viscosity and molecular weight determinations, as well as by slight variations in the molecular weight distributions of polymers under test.)

These limitations are evident in Figure 1, which presents a graph of Mooney viscosity at 212° F. *versus* Staudinger molecular weight for IIR polymers of molecular weights in the range 30,000 to 55,000. It may be seen that at this temperature Mooney viscosity reaches a plateau at about 80 Mooney points and falls off slowly with polymers of molecular weight greater than 48,000. IIR polymers of extremely high molecular weights actually produce readings irregularly scattered about values considerably lower than 80 Mooney points. The increased nerve or toughness of these higher molecular weight polymers is evident in processing; however, it is not reflected in the polymer's Mooney values at 212° F.

Closer Mooney Control Needed

Close control over the production of high molecular weight butyl rubber gained increased importance as the demand for high Mooney butyl rubber grew in the inner tube industry and recently in butyl tire tread applications. Increased production of high molecular weight butyl rubber made it necessary to develop a

[1] M. Mooney, *Ind. Eng. Chem. (Anal. Ed.)*, 6, 147 (1934).
[2] H. Staudinger, *Z. Elektrochem.*, 49, 7 (1943).

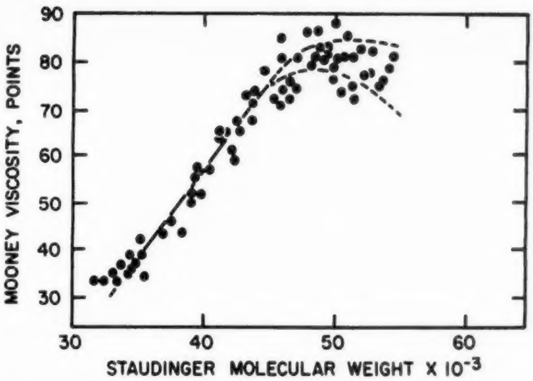


Fig. 1. Mooney viscosity (ML-8 minutes at 212° F.) *versus* Staudinger molecular weight for butyl rubber. At 212° F., Mooney viscosities reach a plateau at about 80 points and fall off slowly as molecular weights exceed 48,000. Dotted lines indicate the range of values which may be expected with these extremely high molecular weight butyl polymers

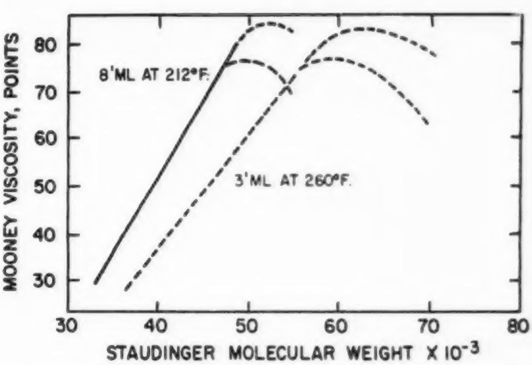


Fig. 2. Mooney viscosities (ML-8 minutes at 212° F.) and (ML-3 minutes at 260° F.) *versus* Staudinger molecular weight for butyl rubber. The recommended operating conditions of three minutes' shearing time at 260° F. extend a viscometer's working range to include butyl rubber polymers which have a 59,000 Staudinger molecular weight

test modified to include polymers of molecular weight above the range of present specifications and suitable for quality control.

The earliest published treatment of this problem was made by F. L. Roth and G. E. Decker.[3] Their investigations showed that the low, erratic nature of readings taken with tough polymers (butyl, SBR, and unmilled *Hevea* were included in the study) were accounted for by slippage and, in a few instances, crumbling of the polymer in the die cavity. It was found that the problem could be overcome by either decreasing the viscometer's rotor speed or by increasing its operating temperature. There were also indications that the problem could be somewhat relieved by altering the design and surface treatment of standard Mooney rotors.

Roth and Decker held decreased rotor speeds to be the better method of improving the correlation between Mooney viscosity and Staudinger molecular weight. They noted that while temperatures higher than 212° F. improved the correlation, temperatures even as high as 292° F. did not bring the viscosities of extremely high molecular weight butyl rubbers in line with their expected values. At 260° F., a correlation was obtained for molecular weights below about 69,000. These authors also felt that a Mooney viscometer could not operate long at these elevated temperatures because of temperature control and machine maintenance problems likely to be encountered.

In practice, low rotor speeds have not been used to determine Mooney viscosities for two important reasons. First, an industry standard based on low rotor speeds would require extensive mechanical alteration of existing viscometers and their controls. Second, rotor speeds in the order of 0.01 rpm. are required to correlate Mooney viscosity with Staudinger molecular weight for polymers of extremely high molecular weight. Approximately 30 minutes are required for rotor speeds in this range to produce equilibrium values.[3] Runs of this length are prohibitive where determinations are made with the frequency essential to quality control. Accordingly, high-temperature operation seemed preferable to the use of low rotor speeds.

Value of 260° F. Mooney Determinations

More than five years of experimental work with elevated temperature determinations (ML-3 minutes at 260° F.) at IIR plants have produced no operating difficulties attributable to high-temperature operation of viscometers used with the frequency normal to quality control. Of greater importance, perhaps, it has been shown that only 2.1% of the butyl rubber produced in a six-month test period exceeded 59,000 Staudinger molecular weight. This would lead one to expect only an infinitesimal proportion of total production to exceed the correlatable upper limit of 69,000 reported by Roth and Decker. Elevated temperature testing has an added advantage in that it requires no mechanical change of existing viscometers. Three-minute determinations are rapid and facilitate close quality control. As will be shown later, the accuracy of three-minute determinations at 260° F. is equivalent to that obtained with eight-minute determinations at 212° F.

Mooney values at 212° F. (ML-8 minutes at 212° F.) and at 260° F. (ML-3 minutes at 260° F.) are compared with Staudinger molecular weight in Figure 2. It may be seen that the latter temperature broadens the useful range of Mooney determinations to include higher molecular weight polymers. It is apparent, then, that Mooney values taken at three minutes and 260° F. are a reliable measure of currently produced high molecular weight butyl rubber; whereas those taken at 212° F. are not.

[3] India RUBBER WORLD, 128, 339 (1953).

TABLE 1. REPRODUCIBILITY OF MOONEY DETERMINATIONS

(Y-110 Butyl Rubber)

Conditions	ML-3 Min. @ 260° F.		ML-8 Min. @ 212° F.		Extrapolated* ML-8 Min. @ 212° F.	
Number of Tests	19	24	30	31	19	24
Viscometer Readings						
High	53.0	53.0	75.0	75.0	75.0	75.0
Low	51.0	50.0	72.0	73.0	72.0	70.0
Average	52.1	52.0	73.6	74.0	73.5	73.1
Standard Deviation	0.8	0.8	0.6	0.7	1.0	1.2

*ML-8 minutes at 212° F. values extrapolated from ML-3 minutes at 260° F.

Tests run for a single polymer at three minutes and 260° F. produce an acceptable standard deviation equivalent to that obtained at eight minutes and 212° F. Extrapolations of ML-3 minutes at 260° F. values to ML-8 minutes at 212° F., however, multiply the deviation to an objectionable level.

TABLE 2. EXTRAPOLATION OF 8-MINUTE MOONEY AT 212° F. FROM 3-MINUTE MOONEY AT 260° F.

ML-3 Minutes at 260° F.	Extrapolated ML-8 Minutes at 212° F. 0	1	2	3	4	5	6	7	8	9
30	44	45	47	48	49	50	51	53	54	55
40	56	57	58	59	61	62	64	65	67	68
50	70	72	73	75	77	79	81	83	85	87
60	89	91	93	95	97	99	101	103	106	108
70	111	113	117	120	123	126	130	130+	130+	130+

This chart is included so that values reported under the new specifications may be compared with values reported earlier. Conversion between the two systems may be made only at the sacrifice of accuracy. In the preparation of this table, ML-8 minutes at 212° F. values have been extended beyond their working range.

The curves shown in Figure 2 decrease linearly and converge slightly as molecular weight decreases. Viscosities at 260° F. remain lower than viscosities at 212° F. for all values of molecular weight. IIR polymers of molecular weight 33,000 and 40,000 have Mooney viscosities between 30 and 55 when measured at 212° F. At 260° F. the viscosities of polymers in this range decrease to values below 30 Mooney points and enter the range wherein experimental error is of significance. From this it is concluded that the viscosity of low molecular weight butyl rubber is still best measured at 212° F.

Accuracy is not sacrificed when the viscosities of high molecular weight polymers are determined at three minutes and 260° F. Table 1 presents the results of a series of viscosity determinations made with Y-110 butyl rubber.[4] These tests were made to compare the accuracy of viscosity determinations made at three minutes and 260° F. with that of eight-minute, 212° F. values. Standard deviations of 0.8 and 0.6 to 0.7 for ML-3 minutes at 260° F. and ML-8 minutes at 212° F., respectively, are comparable and in both cases satisfactory.

Experience with ML-8 minutes at 212° F. Mooney viscosity is extensive in the rubber industry, and a conversion chart is presented in Table 2 for those who may prefer to refer ML-3 minutes at 260° F. values to 212° F. Data for this table have been extrapolated to extend beyond the accurate range of determinations made at 212° F. Conversion multiplies the apparent experimental error to an objectionable level, however, and is therefore inadvisable. To illustrate this point, Table 1 also contains ML-3 minutes at 260° F. values converted to ML-8 minutes at 212° F. for Y-110 butyl rubber. The standard deviation of converted values is 1.0 to 1.2, and, as a result, conversion produces an expected variation of ±2.0 to 2.4 Mooney points at a 95% confidence level.

Summary and Conclusions

The principal findings of this investigation on Mooney viscosity are as follows:

(1) ML-3 minutes at 260° F. is a more accurate definition of currently produced high molecular weight butyl rubber than is ML-8 minutes at 212° F. Eight-minute determinations at 212° F. are still recommended for low molecular weight polymers, however, since 260° F. values for polymers below 40,000 Staudinger molecular weight are inaccurate.

(2) A standard deviation of 0.8 is obtained with ML-3 minutes at 260° F. This figure is equivalent to the experimental error at 212° F.

(3) All IIR polymers being produced currently do not exceed molecular weights which can be correlated accurately with Mooney viscosities determined at 260° F.

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[4] Y-110 designates a particular large sample of butyl rubber of closely controlled characteristics for use as a standard of molecular weight, cure rate, etc., distributed through the National Bureau of Standards.

MEETINGS and REPORTS

ASME Rubber & Plastics Meeting Emphasizes Plastic Pipe and Film

The Rubber & Plastics Division of the American Society of Mechanical Engineers held two technical sessions as a part of the annual meeting of the parent Society which was held at the Chalfonte-Haddon Hall Hotels in Atlantic City, N. J., November 30 through December 4. The Rubber & Plastics Division's sessions took place on November 30.

R. D. Stiehler, National Bureau of Standards, 1959 chairman of the Division, presided at the meeting of the executive committee at which the October, 1960, joint conference with the Erie, Pa., section of the Society, and other matters were discussed. The 1960 Division chairman is C. H. Adams, Monsanto Chemical Co., and the new secretary is M. O. Longstreth, Dow Chemical Co.

The papers presented at the Division's sessions on November 30 and their preprint numbers are given below. Preprints are available from ASME, 29 W. 39th St., New York 18, N. Y. Their price is 40¢ each for members and 80¢ each for non-members.

Division Program

"Uniform Two-Way Orientation of Plastic Films," by M. O. Longstreth and Turner Alfrey, Jr., both of Dow Chemical Co., Midland, Mich. Paper No. 59-A-113.

"Videne — A New Polyester Laminating and Surfacing Film," C. W. Taylor, Goodyear Tire & Rubber Co., Akron, O. Paper No. 59-A-316.

"Plastics in Construction and Agriculture," T. E. Werkema, Dow Chemical. Paper No. 59-A-261.

"Plastics Developments: 1958-1959," Lois W. Brock, General Tire & Rubber Co., Akron. Paper No. 59-A-313.

"Plastic-Pipe Standards," Gordon M. Kline, NBS, Washington, D. C. No preprint available.

"Polyethylene-Pipe Progress," by Alfred Stockfleth, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. Paper No. 59-A-321.

"Factors Affecting the Long-Term Performance of Polyethylene Plastic Pipe," W. Paul Acton, Hercules Powder Co., Wilmington, Del. Paper No. 59-A-323.

"Rubber Developments: June, 1957-June, 1959," by Leora A. Straka, Goodyear. Paper No. 59-A-309.

These papers were summarized by the technical sessions chairman, R. F. Westover, Bell Telephone Laboratories, Murray Hill, N. J.

This year the Rubber and Plastics Division of ASME placed emphasis on two of the fastest growing segments of the plastics industry, plastic pipe and plastic films.

A review of the 11 years of plastic pipe progress leading up to that industry's 200-million-pound annual output revealed many of the significant developments in materials, processing, applications, and standards. The factors affecting and the methods for predicting the long-term performance of polyethylene plastic pipe were discussed in detail. In particular, a method was described for extrapolating to beyond 50-year service life from accelerated tests.

The plastic pipe picture was further colored by an up-to-the-minute coverage of all pertinent plastic pipe standards for the major plastic pipe materials. The various standardization criteria employed by the numerous standards organizations were discussed and described in detail.

Attention was drawn to the large and varied usage of plastic films in the construction industry and in agriculture. Recommendations based upon physical properties of various polymeric materials were made for the diverse film applications encountered in these two industries.

Videne, a clear, unoriented, amorphous, polyester laminating and surfacing film has joined the family of thermoplastic films. Physical, chemical, electrical, and thermal properties of Videne were discussed in detail and were related to this material's range of applications.

A new and ingenious method of producing uniform two-way orientation of plastic films was introduced to the film industry at this meeting. A step-by-step analysis was presented of the polymer mechanics and the ensuing mechanical development leading up to the present continuous operation machine. Physical property advantages of this oriented film as well as production advantages were dealt with.

C. H. Adams, 1960 chairman of the Rubber & Plastics Division of the ASME

The outstanding highlights of the last few years in the endless search for new and better polymeric materials and processes were summarized to two reference-laden literature surveys, one emphasizing recent rubber developments and the other plastics developments.

Special 1960 Engineers Conference

The next meeting of the Division will be a National Conference of Rubber and Plastics Engineers to be held in cooperation with the Erie Section of ASME on October 9, 10, and 11, 1960, at the Hotel Lawrence, Erie, Pa.

The technical program will cover four major areas of subject classifications. These will be (1) vibration and shock control, (2) bonding of engineered structures, (3) non-rigid structures, and (4) automation of rubber and plastic processing.

An industrial exhibit will also be a feature of the conference. Another special feature will be a luncheon, October 11, with Dr. Turner Alfrey as speaker.

The committee includes: exhibits, D. J. Beecher, American Sterilizer Co.; hospitality, S. B. Campbell, Lord Mfg. Co.; plant tour, M. D. Gunselman, General Electric Co.; publicity, R. M. Whiting, Skinner Engine Co.; Tuesday luncheon, A. G. Gifford, Lord Mfg.; social affairs, J. R. Schrecongost, G-E; with the general chairman being G. H. Billman, Lord Mfg.

Meetings and Reports

Attention, Materials Suppliers

The third edition of "Compounding Ingredients for Rubber" will soon be published. This will be a very complete directory of ingredients available in the United States. Your materials should be considered for this publication.

Requests for information were mailed early in January. If you did not receive this mailing, please let us know immediately. If you have not yet replied to our letter, please do so as soon as possible. Publication cannot be delayed.

Only copy which is in our hands by March 1, 1960, will be considered for inclusion in the book.

RABRM Foam Symposium

The importance of cellular rubber materials in the furniture and allied industries has become increasingly evident in recent years, and this was emphasized by the Research Association of British Rubber Manufacturers (RABRM) and the British Furniture Development Council (FDC) when they sponsored jointly a very successful symposium on "Rubber Cushioning and Upholstery," which was held from November 9 to 12, 1959, at Attingham Park, a fine Georgian Eighteenth Century mansion near Shrewsbury in England.

The symposium included lectures from RABRM staff on "Different Kinds of Foam," by A. L. Soden; "Load-Deflection and Other Elastic Properties of Foams," by A. E. Eagles; and "Preparation and Use of Purchasing Specifications," by R. C. Moakes. Other lectures presented were by R. L. Dunn, of Dunlop Rubber, Ltd., on the use of foamed rubbers; by D. Young, Natural Rubber Development Board, on design with foamed materials; and by M. J. Merrick, of the FDC, on properties, feel, comfort, and durability of foams. The last-named also discussed the possible future development in this field. On the last day of the meeting the delegates were shown over the laboratories and library of RABRM.

These symposia are held by RABRM two or three times a year. Other sessions were held in 1959 on rubber in engineering and on millrooms, mastication, and mixing. There are two objectives, either to put over by personal discussion to a selected audience some aspects of research work of the RABRM staff or to get together fabricators and users for a better understanding of each other's ways of thinking and points of view.

Second Conference On Insulation a Success

The second annual National Conference on the Application of Electrical Insulation was held in Washington, D. C., at the Shoreham Hotel on December 8, 9, and 10, 1959. Cosponsors of the conference were the National Electrical Manufacturers Association and the American Institute of Electrical Engineers.

General chairman for the conference was H. H. Chapman, Owens-Corning Fiberglas Corp.; with M. Nakonechny, Dow Corning Corp., as technical program chairman; and J. S. Hurley, Jr., General Electric Co., C. B. Leape, Westinghouse Electric Corp., and R. B. White, The Glastic Corp., serving as assistant chairmen. Local arrangements were handled by a committee headed by J. Jessel, Federal Power Commission, and F. Criter, General Electric Co., as cochairmen.

The conference consisted of 18 sessions during which about 80 papers were presented on all phases of electric insulation. Session 11, which contained five papers on silicone rubber insulation systems, was of particular interest to the rubber industry. Titles and authors of these papers, which were reproduced in full in the conference proceedings book, are as follows: "Application of Silicone Rubber in High Voltage Electrical Rotating Equipment," by G. R. Betzhold, Allis Chalmers Mfg. Co.; "Considerations in the Production of Silicone Rubber Insulation for Form Wound Coils," H. W. Lynch, Moxness Products, Inc.; "Evaluating Voltage Endurance of Silastic Insulation Systems," D. M. Bartos, Dow Corning; "Bondable Silicone Rubber Tapes with Improved Electrical and Physical Properties," R. A. Ward and J. W. Wetzel, General Electric; and "Developments in Silicone Rubber for Application in Insulation Systems," by J. E. Rogers, silicones division, Union Carbide Corp.

Record Chicago Party

The annual Christmas party and Ladies Night of the Chicago Rubber Group was held on December 18 with a capacity crowd of 888 at the Morrison Hotel, Chicago, Ill. The program consisted of a cocktail hour, a seven-course capon dinner, entertainment in the form of four specialty TV and night club acts, and dancing after the show. The ladies in attendance were presented with a ladies electric shaver with the compliments of the Group.

The committee in charge expressed its appreciation to more than 170 rubber manufacturers and raw material suppliers who made the party possible.

The committee consisted of chairman Robert V. Varick, Fred A. Jensen & Associates; vice chairman, Fred Klepetar, Johns-Manville Corp.; Alfred G. Cobbe, Godfrey L. Cabot, Inc.; Angelo M. Gabriel, Brummer Seal Co.; Larry W. Heide, Acadia Synthetic Products Division; G. Richard Huhn, Harwick Standard Chemical Co.; C. E. Huxley, Enjay Co., Inc.; Vince Labrecque, Victor Mfg. & Gasket Co.; and O. H. McCollum, E. I. du Pont de Nemours & Co., Inc.

W. Midland Photo Services, Ltd.

Group at RABRM lecture listening to M. J. Merrick discuss rubber cushioning and upholstery

Philadelphia Rubber Group members study data on natural and synthetic natural rubbers during technical session. Seated at the head table are *(left to right)* R. N. Hendrikson, vice chairman and program chairman; H. C. Remsberg, chairman; H. C. Bugbee *(standing)* panelist; H. E. Railsback and H. R. Nebeker, panelists

Philadelphia Rubber Group Hears Talks On NR, IR, and *Cis*-4

A record number of members and guests attended the Philadelphia Rubber Group meeting on January 22 in the Poor Richard Club, Philadelphia, Pa. More than 225 heard the panel talks on polyisoprene, polybutadiene, and natural rubber. Following the panel the Group held the usual cocktail hour and dinner. Speaker for the dinner was "Chuck" Bednarik, outstanding center for the Philadelphia Eagles professional football team. Bednarik gave many humorous insights into the close-up picture of pro football including some of his personal "feuds" and the feelings of the players when a member of the opposition runs the length of the field for a touchdown. After his talk, a film was shown of many of the outstanding plays which occurred during the 1959 Eagles' season.

The afternoon technical session featured the talks on natural rubber and the two closest synthetic polymers in production at this time. The information on Shell's *cis*-polyisoprene was given by H. R. Nebeker, Shell Chemical Corp., Torrance, Calif. CIS-4, Phillip's trade name for *cis*-4 polybutadiene, was described by H. E. Railsback, Phillips Petroleum Co., Akron, O. The position of natural rubber in the picture was given by H. C. Bugbee, Natural Rubber Bureau, Washington, D. C.

Synthetic Rubbers Discussed

Both Mr. Nebeker and Mr. Railsback covered the current production on pilot-plant levels of their respective materials, and some of the information on compounding available at the present time. The Shell polyisoprene was described as matching fairly well the properties of natural rubber.

There are, however, some differences which are explained as stemming from the fact that this polymer is not 100% *cis* polymer. The difference most noticeable, since it affects processing, is the lower green strength of the synthetic polymer. In gum stocks, this lack of green strength produces stocks with less modulus than a similar stock using natural rubber. In carbon black loaded stocks, tensile and modulus are somewhat lower than for equivalent natural stocks. A compensating plus factor attributed to this lower green strength, however, is much improved mold flow of the synthetic product which permits very close match to mold cavities and particularly deep undercuts or other intricate shapes. The color of this *cis* polyisoprene is very good, described as almost white, and reported to be quite stable.

In describing CIS-4, Mr. Railsback admitted that processing is the major problem in using the material, and he indicated that at this time it was a still unsurmounted problem. The polymer acts well on a mill as long as the temperature is held under 110° F., but it becomes rough and hard to band above 125° F. This is true for both new rubber or previously milled polymer and includes compounded stocks. The speaker indicated that blends of CIS-4 and natural in a ratio of 75 parts CIS-4 and 25 NR can be processed in many cases, but that 50/50 ratio seems to be most practical for general applications. While physical properties in general are somewhat lower for an all-CIS-4 compound, when compared to SBR 1500 or to an all-natural stock, the abrasion resistance, running temperature, and crack growth, when a 50/50 blend of NR and CIS-4 is used for truck tires, make CIS-4 an interesting material.

Both Railsback and Nebeker indicated that present supplies have been sold with the idea that users interested would be given enough to make full trials, but that there was not enough to allow real factory production. Both Phillips and Shell have announced, however, that 20,000 long tons per year plants are under construction and should be on stream late in 1960. This added capacity would permit greater use of these polymers than at present, allowing users of these materials an opportunity to make production runs on at least some items.

Natural Rubber Forecast

In his talk on natural rubber, Mr. Bugbee discussed the problem from the marketing and supply angle. Admitting that natural rubber would probably lose out slightly in its percentage of world consumption, he indicated confidence that actual consumption of natural rubber would continue to increase, would continue to use all available stocks, and would continue to improve in quality. For the next year or two the forecast is for an actual deficit in production, as compared with consumption of natural, which may be offset in full or in part by the stockpile sales of the United States and Britain. By 1965, however, with production up some 400,000 tons per year, sales of natural rubber will still utilize all that can be produced.

Mr. Bugbee stressed the research that has been going on both in Malaya and Britain to improve natural rubber as being very important to natural's ability to hold and increase its markets. This ranges from improved trees and planting and growing information to the modification and utilization of the product. He stated that this research would continue on an increased and directed basis under the new world-wide set-up. This speaker also stated that technical service would be stepped up. Commencing February 1, 1960, the first member of a technical service group in the United States will start his duties. This follows the successful use of such a service in the United Kingdom.

Under questioning following the talks, Mr. Bugbee discussed the price of natural rubber expected in the future. He pointed out that natural rubber prices are set by a free market subject only to supply and demand and not to government interference. He expects that the price of the natural product will be close to the synthetic natural's price, particularly when greater production of the synthetics becomes a reality.

The two men representing the synthetic field, Nebeker and Railsback, did not expect any price change in their products in the immediate future, but both indicated that they were in the technical departments of their companies and would not necessarily be aware of decisions along this line. Both men pointed out again during the ques-

tion period that at present the companies were not trying to produce large quantities of these materials, but enough for development projects. Additional production facilities may be forthcoming if the predicted shortage of natural rubber creates sufficient demand for the synthetics to make it desirable.

Rubber Division Plans May Spring Meeting

Some preliminary details of the spring meeting of the Division of Rubber Chemistry of the American Chemical Society have been made known to the membership in a letter from the secretary, R. H. Gerke. The meeting is scheduled for May 4, 5, and 6, 1960, and will be held in the Statler Hilton Hotel, Buffalo, N. Y.

As usual, the first activity scheduled is the 25-Year Club luncheon on Wednesday, May 4, with C. H. Peterson presiding. The first technical session will follow at 2:00 p.m. the same day, with the Division chairman, W. J. Sparks, presiding.

The two technical sessions on Thursday, May 5, will be headlined by lectures on polymers by two of the most well-known figures in this field. The morning session will feature a talk on "Latest Advances and Break-Throughs in the Physics of Polymers," by Prof. P. Debye, retired, Cornell University, Nobel Prize winner in chemistry for original contributions on molecular structure. The afternoon session will be highlighted by a talk on "Latest Advances and Break-Throughs in the Chemistry of Polymers and Polymerization," by Prof. H. Mark, retired, Brooklyn Polytechnic Institute, an international authority on polymer chemistry.

The Secretary's letter included a call for papers. Deadline for submission of the required seven abstracts to the Secretary is March 10. These 200-word abstracts should tell why the work was undertaken, what the results were, and are the results useful and significant. The letter of transmittal should indicate author(s), including one ACS member, laboratory location, person to deliver paper, and time required. Six copies of the paper should be available ready for publication at the time the paper is delivered.

The 1960 Charles Goodyear Medal will be awarded to W. B. Wiegand, retired, Columbian Carbon Co. The medal, scroll, and honorarium will be presented at the banquet Thursday evening, and the lecture by Dr. Wiegand, "Determinants in Research," will be presented during the business meeting at 11:00 a.m., Thursday morning. The Division executive committee selected Dr. Wiegand at the Washington International Rubber Conference and cited him for research on reinforcement of rubber by carbon black.

Ontario Group Party

The Ontario Rubber Group held its annual Christmas party December 10, at the Fischer Hotel, Hamilton, Ont.

P. E. Gnaedinger, director of operations research, management engineering department, Dominion Rubber Co., Ltd., spoke on "Basis for Inventory Control." He covered the financial aspects and savings made possible by effective control of the inventory and also stock control by statistical methods along with production planning and forecasting.

A large gathering of members and guests was present. The meeting ended with the drawings for many donated gifts.

Du Pont Reclassifies "Adiprene" LD-167

A second liquid urethane elastomer of the "Adiprene" L type[1] has been removed from the experimental classification as the result of increased acceptance, growing interest in the broad range of properties offered by the versatile new materials, and improved production technology, reports E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

The material formerly known as LD-167, is now identified as "Adiprene" L-167 urethane rubber. The original product in the field—"Adiprene" L—is now termed "Adiprene" L-100, in order to start a standard of nomenclature for this family of urethane elastomers. A third product, LD-213, continues in the experimental category for investigation by industrial users interested in elastomeric products with extreme hardness and exceptional resistance to impact and abrasion.

"Adiprene" L-167 offers Shore A hardness readings in the 90 to 98 range, with Shore D values from 37 to 67. Elongation is 350% and tear strength 150 pounds per inch (ASTM D 470). Compression set in a typical formulation, measured by Method A (ASTM D 575A) after 22 hours at 70° C. and pressure of 1,350 psi., is 8%, and Bureau of Standards abrasion index reading is 275.

"Adiprene" L urethane rubbers are being used increasingly for industrial tires, rolls, mechanical goods, potting compounds, and a variety of defense uses.

[1] See RUBBER WORLD, May 1959, p. 286, Dec., 1958, p. 421.

Detroit Group Elects

The Detroit Rubber & Plastics Group, Inc., sponsored by the Division of Rubber Chemistry of the American Chemical Society, held its annual Christmas meeting on December 11 at the Statler-Hilton Hotel, Detroit, Mich. Six hundred and fifty members and guests enjoyed a program of entertainment.

Officers installed for 1960 were: chairman, Walton D. Wilson, R. T. Vanderbilt Co.; vice chairman, S. Miller Sidwell, Chrysler Corp.; secretary, Richard W. Malcolmson, E. I. du Pont de Nemours & Co., Inc.; and treasurer, Phillip V. Millard, Automotive Rubber Co.

Other members of the board of directors are: counselors, W. F. Miller, Yale Rubber Co.; E. J. Kvet, Jr., Detroit Arsenal, U. S. Army; H. W. Hoerauf, United States Rubber Co.; program chairman, R. C. Waters, truck and coach division, General Motors Corp.; assistant program chairman, P. Weiss, research laboratories, General Motors; assistant secretary, E. Francis, Ford Motor Co.; publicity chairman, C. E. Beck, St. Clair Rubber Co.; historian, T. W. Halloran, Chemical Products Co.; membership chairman, J. Masden, U. S. Rubber; assistant membership chairman, E. I. Bosworth, Columbian Carbon Co.; education committee chairman, R. Snyder, U. S. Rubber; assistant treasurer, F. Falvey, Du Pont; entertainment chairman, R. C. Chilton, Permalastic Products Co.; assistant chairman education committee, C. H. Albers, Baldwin Rubber Co.; and program committee member, J. McClellan, Wyandotte Chemical Co.

Students Learn About Materials Development

Included in a series of five lectures for students in the Washington, D. C., area were one on plastics and one on rubber. The series was sponsored by the National Bureau of Standards and five local technical societies and was called, "Materials Development in the Space and Atomic Age."

Types of materials covered included solids in general as well as metals and ceramics in addition to the plastics and rubber.

The lecture on plastics was sponsored by the Baltimore-Washington Section of the Society of Plastics Engineers, Inc., was delivered by George Flanagan, B. F. Goodrich Co., and was titled, "Modern Plastics Technology—A Challenge of Materials and People." The rubber lecture was titled, "Revolution in Rubber Through Science," was delivered by Robert D.

(*Continued on page 703*)

WASHINGTON REPORT

By JOHN F. KING

Country's Research Spending To Grow, and Pattern Change

The economist has taken the scientist to the top of the mountain for a dazzling view of the latter's role in the American economy during the next decade.

R & D Expenditures To Rise

Forecasting expenditures for research and development during the next decade, three nationally known experts from the McGraw-Hill Publishing Co. told the American Economics Association's annual meeting in Washington on December 30 that total government, industry, and university outlays for R & D will soar from the current level of $12 billion a year to $22 billion by 1970.

In terms of constant 1959 dollars, the level of R & D expenditures by the end of the decade should total $17.5 billion, they said.

The three economists—Dexter M. Keezer, M-H vice president in charge of the economics department, Douglas Greenwald, chief statistician, and Robert P. Ulin, senior economist of the department—said the forecast was prepared from estimates of the National Science Foundation, the Defense Department, the Bureau of Labor Statistics, the Census Bureau, and McGraw-Hill economics department. They added that once compiled, the forecast was turned back to the National Science Foundation, whose staff members checked and rechecked "and could not improve upon it."

Eisenhower on R & D

Following on the economists' forecasts was President Eisenhower's fiscal 1961 budget message, submitted January 18 to Congress, projecting a 6% increase in government-sponsored research and development programs. Because of generally expanded R & D outlays in the military establishment and a variety of other non-military projects, the budget forecast that $8.4 billion of the total fiscal 1961 budget of $79.8 billion would be allotted for scientific projects. This compares with total R & D expenditures of $7.9 billion of the $80 billion budget in fiscal 1960.

Of particular interest to rubber industry technicians are figures showing the increased appropriations requested in the new budget for the National Bureau of Standards and the National Science Foundations.

NBS, which received only $12.5 million in fiscal 1959 for its research efforts, will get $19.6 million in fiscal 1961 if Congress appropriates what Mr. Eisenhower asks. NSF for its part would be boosted from $136 million in 1959 appropriations to a hefty $190 million for basic research projects in fiscal 1961. The appropriation requests also are substantially higher than the $17.2 million Congress appropriated for NBS in fiscal 1960 and the $155 million NSF received in the same year.

Research Pattern to Change

In addition to forecasting totals, the three economists took a long look at the changing patterns of research through the Sixties and decided that by the end of the decade a smaller share of the total will be devoted to government research—particularly defense-type—and larger shares relatively will be devoted to industrial and to basic research generally than is now the case.

Their paper said that in fiscal 1959 the government spent $7.2 billion on R & D, of which $5.8 billion was connected with the defense program. Private industry at the same time was spending $4.5 billion; while the universities were laying out a little over $300 million.

Forecasting government expenditures over the next 10 years, the report assumed that weapons spending will be reduced or held relatively constant, but that R & D will go on growing. It gave two reasons: (1) "Whatever armaments we do produce will be more complex, in a scientific sense"; and (2) Any cut in key arms programs "would probably mean a shift of some resources to semi-civilian projects. . . .

"In fact," it continued, "a good theoretical case can be made that a shift (from arms to civilian applications) would accelerate R & D spending. Some of the detection and warning devices required to police an effective disarmament scheme would require more extensive R & D than the weapons they are supposed to detect."

While defense R & D outlays will continue to grow, these expenditures will "increase at a slower rate during the next decade than they have in recent years." Specifically, the above report forecast government efforts would then be stepped up by $400 million a year during the decade to about a $16-billion level in 1969.

Non-defense government research in such fields as medicine, agriculture, and the support of "pure science" in the educational institutions is just as difficult as defense spending to forecast, the experts said, because of "political considerations" such as the mood of Congressional appropriations committees. But as a "conservative bet," they guessed that non-defense R & D done directly by the government will double to $2 billion by 1970.

Private Research Spending

Turning to private spending for research, the report forecast that industrial R & D, running at a $4.5 billion total last year, should "at least" double by 1969, and university outlays will grow even more on a percentage basis, though the absolute share of total R & D here will remain small.

As to who will do the bulk of the research involved in all this spending, the report said that "whereas government has been and will continue to be the biggest provider of funds, industry has been and will continue to be the main performer. . . . It is noteworthy, however, that colleges and other institutions will increase their share of R & D performance over the next decade." Why? Because the increasing public awareness of the need of scientific research has speeded up the flow of contributions (including business contributions) to non-profit institutions, the report explained.

Basic and Applied to Increase

Discussing the types of work that will feature the Sixties, the report fore-

cast another substantial change in the picture. "Product development will still be the predominant type of project, but basic and applied research will increase to 41% of the average research dollar, compared to 30% in 1959. The shift will result mainly from less emphasis on defense work (more on basic science) in the government sector, and partly from a trend toward complex R & D (as opposed to more gadgetry) in industry."

The report estimated that only $3.6 billion of the total $12 billion spent last year on scientific inquiry was funneled into basic and applied research. It noted, moreover, that this small slice was concentrated in a relatively few industries, such as aircraft, electronics, heavy machinery, and electrical products, whether done in government, industry, or the universities.

Spurring the shift toward more expensive basic research in industry, the report said, is the sharpening competition in business today. R & D as a competitive weapon offers new or improved products as well as a means to cut labor, material, and manufacturing costs, it continued. Further contributing to this shift, the report added, is the fact that the large backlog of applied research information is being chewed up at a rapid rate. While business preoccupation with R & D should intensify, the rate of growth of spending in the industrial sector will not match the pace set in the Fifties, when industrial expenditures were triple the $1.4 billion annual rate at the end of the 1940's, the report stated. This spending should only double from $4.5 to $9 billion, it added.

As a last point, the three experts forecast that the main burden of stepping up R & D during the coming 10 years falls on a relatively few large companies, most of whom are defense contractors, the universities, and the government.

"Very few companies have such broad production or marketing facilities that they can use whatever is discovered, and very few have the capital to wait out the long periods of basic research plus applied research before they get to product development," the experts explained.

Eisenhower 1961 Budget Includes Plant Disposal and Stockpile

President Eisenhower's fiscal 1961 budget projecting a fat $4.2 billion surplus, which he describes as businesslike and "sound" in every respect, marks the official end of two major government rubber programs. The President said in his budget that the last of the government-owned synthetic rubber plants, built during World War II, will be disposed of. At the same time, without specifically saying so, the budget message indicated that the liquidation of about 40% of the natural rubber stockpile, begun late last year, will be pressed forward.

Highway Program Taxes

The only other major item of interest to the rubber industry which stands out in Mr. Eisenhower's fiscal 1961 budget—the last he will present to Congress—is the renewal of his demand of last year for higher "user" taxes to keep the highway construction program proceeding on schedule. As it did last year, the increased tax proposal is expected to arouse the opposition of tire manufacturers.

Specifically on the highway program, the Chief Executive urged that the tax on motor fuels be raised another half-cent per gallon to the level of 4.5¢ for a period of five years. Congress last year approved only a flat 1¢ increase for a period of less than two years.

Mr. Eisenhower also declared in his new budget that "at the appropriate time, further recommendations will be made to the Congress for the ensuing conduct and financing of the program" which he claimed "has been slowed below a desirable rate of progress" for want of adequate tax revenues.

Synthetic Rubber Plants

Word that the government in the coming year intends to liquidate synthetic rubber plants still unsold to private industry was less prominent in the bulky budget, but it nonetheless was there. The document noted that the Louisville, Ky., alcohol butadiene plant has been transferred from the Federal Facilities Corp., a housekeeping agency, to the Public Buildings Service for disposal this year. The only remaining government-held property from the synthetic rubber program—the catalyst manufacturing equipment in Baltimore—also will be disposed of in 1960. With these transactions completed, FFC's "sole remaining function with respect to synthetic rubber is to administer the sales contracts," the budget explained.

Stockpile Rubber

Signaling a further move toward liquidation of 40% of the natural rubber stockpile, the budget noted that Congress in an appropriation bill last year ordered the sell-off to begin after 15 years' sustained stockpiling. It said "similar authority"—apparently referring to the Administration plan unveiled last fall to sell off this 40% of the rubber stockpile over the next eight years—will be formally requested from the legislature later this year.

The budget also estimated that gross receipts from stockpile sales, in lieu of rotation as the Appropriating Committees ordered, will total $36.2 million by next June 30, the end of fiscal 1960, and another $35.7 million in fiscal 1961, which begins July 1. These totals do not reflect sales of rubber only, but disposal in lieu of rotation of other perishable items such as specialty oils and fibers. Rubber is by far, however, the biggest single item in the sale forecasts.

Food Additives Issue Requires Fast Action

The rubber manufacturing industry, generally recognized to be in the business of making rubber products, is wrestling with an issue whose semantics has become the despair of both lawyers and scientists. Briefly, the baffling question, as mentioned last month, is whether rubber products used in the food industry can ever be construed to produce "food additives."

Unhappily for some firms in the industry, the issue is not a fine academic hypothesis for leisurely discussion. Rather, it could become a matter of business survival.

Will Deadline Be Met?

Beginning March 6, the Food & Drug Administration will have the power to prohibit the use of any food additive judged to be harmful to man or animal. If after that date the agency decides that any compound in a rubber product which is used in processing or packaging food (1) is "generally recognized among experts" to be harmful to health and (2) extracts or "migrates out" of its vulcanized form into food, then the government can crack down as it did in the cranberry cancer-crisis of last fall.

The problem thus confronting the rubber industry scientist is formidable, but not half so bad as the problem the March 6 deadline—which was fixed in the 1958 amendment to the Federal Food, Drug & Cosmetics Act—poses for the industry lawyer. It is up to him to make sure his company does not end up penalized for violating the Act, since the burden of proving that harmful rubber compounds do not "migrate out" into the food product with which the rubber comes into contact lies on the manufacturers, not the FDA.

"It's impossible," sums up one industry attorney. He asserts the 1958 amendment left the burden of proof on the companies because Congress recognized that to put it on FDA would entail the hiring of several thousand

additional people to police the new regulations.

"This was supposed to be the easy way to handle it," the attorney commented.

Another "White List"

As matters stood in mid-January, FDA already had issued one "white list" of raw materials and compounds which it has decided are not harmful in the manufacture and processing of food products. It is hoped that the FDA can be induced to issue another such white list, containing a clean bill of health for many rubbers and compounding ingredients, in the next few weeks, or agree to an extension of the deadline of one year as is being requested by other industries involved. Otherwise, as the agency delves into the components going into the manufacture of thousands of products of rubber as well as other industries, the lawyers and scientists will begin feeling the pressure.

The Rubber Manufacturers Association, Inc., already is hard at work drawing up extensive lists of materials going into such products as belting, hose, packing, O-rings, oil seals, sundries, molded and extruded goods, and coated materials. The object is to screen from these lists items on which experience over the years demonstrates to be not harmful to man. The screened items would thereby constitute a basis for discussion with FDA for another white list covering products used in various segments of the rubber industry.

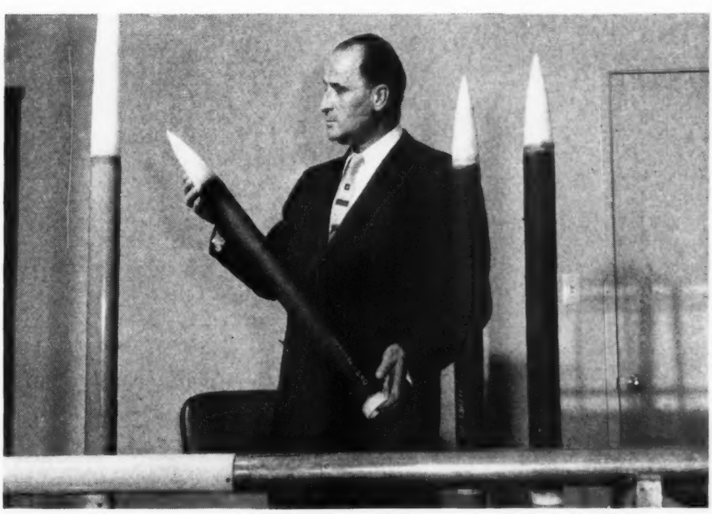
While the search goes on, however, some industry advisers counsel a calmer approach to the whole issue.

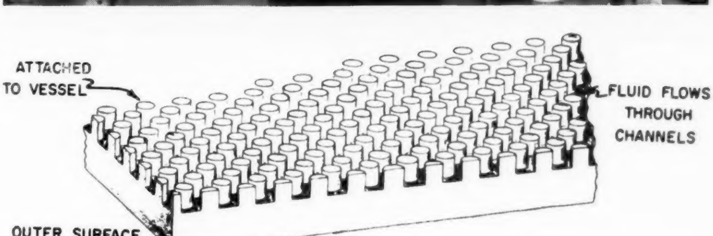
This advice is to the effect that compounds in rubber products used by the food industry cannot, in the terms of the 1958 amendment, be construed to impart an "additive" to the food with which they come in contact. Even when the manufacturer knows compounds in his product "migrate out" into food—if it is "generally recognized among experts" that these compounds are not harmful to health—the manufacturer has nothing to worry about, according to this view.

INDUSTRY NEWS

Special Rubber Surface May Mean New Era in Water Transportation

Vessels may be able to travel through the water at twice their present speeds with the same amount of power or at present speeds with very much less power, if equipped with a new resilient rubber surface, according to announcement made jointly by the United States Rubber Co., New York, N. Y., and Coleman Engineering Co., Inc., Los Angeles, Calif., in New York, January 12.





Underwater test device covered with "Lamiflo" surface held by Dr. Kramer *(top)*, and schematic view of "Lamiflo" surface *(bottom)*

Max O. Kramer, vice president of Coleman-Kramer, Inc., research subsidiary of Coleman Engineering, developed the principle of the special-type surface as a means of overcoming the drag on objects being propelled through water due to turbulence sometimes created, and U. S. Rubber's research center developed the rubber type surface.

The two main factors in achieving maximum speed through water or air have been the smoothness and the shape of the object. These are now joined by a third factor, the elimination of turbulence by damping. An object being propelled through water actually uses from 70 to 90% of the propulsive energy to overcome the drag due to turbulence, created by the object itself.

Dr. Kramer is a leading authority on the reduction of turbulence, which is called "boundary layer stabilization by distributed damping," and a resume of his latest findings is published in the January, 1960, issue of the *Journal of the Aero/Space Sciences*.

The special-type rubber surface consists of about a 1/8-inch rubber sheet supported by tiny rubber stubs, as shown in the accompanying schematic view. The space between the rubber stubs is filled with a damping fluid of the proper viscosity, and the rubber stubs are attached to the surface of the vessel. The turbulent wave motion

created by objects propelled through water at certain speeds is damped out by the combination of the energy-absorbing characteristics of the damping fluid and the rubber, to provide laminar instead of turbulent flow along the surface of the vessel. U. S. Rubber, which expects to produce the drag-reducing rubber surface, plans to market it under the trade mark, "Lamiflo."

U. S. Rubber technologists have already developed surfaces which have reduced drag by about 50% on underwater measuring devices and are experimenting with these surfaces on 20-foot plastic boat hulls. Other studies are now under way to apply the principle of the "Lamiflo" surface to missiles, rockets, planes in flight, and to liquids flowing through pipes, according to W. E. Cake, U. S. Rubber vice president, who believes that boundary layer stabilization could have an effect in all of these instances.

Dr. Kramer has utilized streamlined test devices covered with "Lamiflo" towed at the side of a small motorboat for drag measurements. Instrumentation for these tests is the same as that used in the guided missile field. F. W. Boggs and other U. S. Rubber scientists working with Dr. Kramer on further theoretical studies foresee a whole new area of interest opening up for the rubber industry with this new development.

Vice Admiral Charles B. Momsen, retired Navy submarine expert and co-developer of the Momsen lung escape apparatus, said he believes that submarine speeds of 60 knots (about 70 miles an hour) would be possible with the development of a successful submarine "skin." Admiral Momsen, a consultant to U. S. Rubber, predicts an entirely new era for underwater vessels, such as passenger or cargo submarines designed to sail on regular schedules and completely free from delays by hurricanes, typhoons, and other surface storms. The Navy is aware of the new development but has not participated in the research.

Large surface vessels are less likely to benefit from use of the special rubber surface because they generate large bow waves. Changes in marine design combined with the rubber surface might however, overcome this problem.

Although marine growth on the rubber surface could prevent the surface from performing effectively, Dr. Boggs and Dr. M. A. Brooks, of U. S. Rubber, pointed out that such growth does not occur on rubber as it does on some metals, woods, and other materials.

E. L. Hanna Retires

Ezra Lloyd Hanna, technical manager of Davol Rubber Co., Providence, R. I., retired from the firm on October 31, 1959. About 100 of his coworkers gave a party at the Rhode Island Country Club on October 22, where a TV set was presented him. He was recognized by management for his 42 years of service to Davol, having joined the company in 1917 as chief chemist.

E. L. Hanna

Mr. Hanna was born June 29, 1893, in Akron, O. He attended the Akron public schools and received a Bachelor of Science degree in chemistry from Buchtel College in 1915 (which later became the University of Akron).

He served as a chemist for Star Rubber Co., Akron, during 1915-1916. He had worked vacations in the old Diamond Rubber Co. and at Goodyear Tire & Rubber Co. He also served in the U. S. Army & Chemical Warfare Service during 1918-1919.

Mr. Hanna, who has been very active in civic affairs, also has held numerous positions with different technical societies. Some of these include: charter member and third president of the Rhode Island Rubber Club; director of the Rubber Division, American Chemical Society; member of the Rubber Manufacturers Association Technical Committee, Sundries Division, duration of World War II; and member of Z-79 committee, American Society Anesthesiologists, chairman of endotracheal tube specifications.

Mr. Hanna also has been a member of various Davol organizations including: past president, M.B.A.; past president, Foremen's Association; Davol commercial league bowling team; and Davol golf team. Besides he belongs to the Masonic Order, the American Legion, Phi Delta Theta, and Rho Iota Kappa.

New Neoprene Packaging

New pasted, open-mouth bags for neoprene give better loading, handling, and storage performance and allow quicker identification of type and lot number, according to the elastomer chemicals department, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

The outer-ply of the new bag is treated with "Ludox" colloidal silica to impart non-slip qualities and improve pallet stability. Squared ends of the containers add stability and neatness to pallets, making them easier and safer to handle and facilitating double tiering. In addition, the more compact shape allows use of pallets approximately two inches smaller in each dimension, an aid in loading and unloading by mechanical equipment.

Lot numbers are readily visible on bag ends when stacked. Code letters identifying neoprene types appear on ends, sides, front, and back, and are color-coded for easier identification in storage.

Color codes for neoprene types are: Type AC, all black letters; Type AD, black with red letters; Type CG, black with green letters; Type GN, red with blue letters; Type GNA, all red letters; Type GRT, red with green letters; Type KNR, purple with red letters; Type S, all purple letters; Type W, all green letters; Type WB, green with blue letters; Type WHV, green with black letters; Type WRT, green with red letters; Type WX, green with brown letters; and miscellaneous, two-ply, all blue letters.

Enjay Butyl Expansion

Enjay Co., Inc., recently announced that current modifications and expansions at Esso Standard Oil Co.'s Baton Rouge, La., refinery will increase the annual production on Enjay Butyl rubber by 38,000 long tons. These modifications will provide increased operating efficiency and improved quality control, as well as additional capacity. The total capital cost of improvements now in various stages of design and construction will be $16 million.

During the past several years, sales of Enjay Butyl increased substantially owing to the recognition of butyl's adaptability in a variety of uses, and its outstanding elastic and aging properties. Among the more recent new applications is its use in improved passenger-car tires. Enjay's plant at Baton Rouge, and the Humble Oil & Refining Co.'s plant at Baytown, Tex., are currently producing at the rate of 97,500 long tons per year.

Of the 38,000 long tons of new plant capacity at Baton Rouge, 20,000 long tons will become available in mid-1960, followed by another 18,000 long tons during the second quarter of 1961. This output will increase the total capacity at the Esso and Humble plants to more than 135,000 tons per year.

Enjay reported that added butyl capacity will be provided as it is needed. In fact, further butyl plant expansions are now under study at both Baton Rouge and Baytown.

Pennsalt To Buy Site For Technical Center

Pennsalt Chemicals Corp., Philadelphia, Pa., has concluded negotiations with Cabot, Cabot & Forbes to purchase a 50-acre site in the King of Prussia Park for construction of a technical center which ultimately will represent a $6 million investment. This park, located at the Valley Forge Interchange of the Pennsylvania Turnpike, is one of 14 industrial parks developed by the Cabot company.

The new purchase will permit an orderly expansion of Pennsalt's growing needs for technical facilities; for research, development, and technical service. Currently, Pennsalt operates technical facilities at Wyndmoor and Devon.

Plans call for a campus-type arrangement featuring a central mall. The first building in the complex will be a two-story laboratory occupying approximately 21,000 square feet. This will be devoted to product development and technical service on Pennsalt's proprietary chemicals for the metal working industry, laundry and dry cleaning trade, food and dairy plants, as well as consumer products for farm and home. The Isotron refrigerant and aerosol propellant technical group will also occupy expanded facilities in this new building.

Cabot, Cabot & Forbes will do the design, engineering, and construction on its package-plan basis. Construction of the first building will start early in 1960 and will be completed before the end of the year.

A. J. Northam Retires

Alfred J. Northam, who had a major share in bringing Du Pont's "Hypalon" synthetic rubber to its present stage of commercial development, has elected to retire from the company after a career of 36 years in the rubber industry.

Assistant sales manager in charge of "Hypalon" sales for the last three years, Northam spent the major part of his Du Pont career at the rubber laboratory. Starting in 1927 as a chemist for the former Grasselli Chemicals Co. before it became a part of Du Pont, he was transferred to the rubber laboratory at Deepwater, N. J., in 1929 and was named assistant director there in 1943. In 1953 he was appointed assistant to the sales manager of rubber chemicals in Wilmington, Del., and in 1957 was named to his present position of assistant sales manager, elastomer chemicals department, in charge of "Hypalon" sales.

Mr. Northam was born December 26, 1899, in Accomac, Va. He received his bachelor of science degree in chemistry from the University of Maryland in 1922 and took post-graduate studies the same year at Rhode Island State College while working as a chemist in the college's experimental station at Kingston, R. I. Prior to joining Du Pont, he worked for United States Rubber Co., Bristol, R. I., and the Pennsylvania Rubber Co., Jeannette, Pa.

Alfred J. Northam

In addition to his work on "Hypalon," Northam's broad experience covers virtually every phase of the rubber industry from compounding, research, and development work through demonstration, sales service, and direct sales. His specialties include wire and cable jacketing and the quality control of rubber chemicals. He also has headed up Du Pont's color development work for elastomers and is well known for his many contributions to the technical literature on rubber.

Mr. Northam is a member of the American Chemical Society and its Division of Rubber Chemistry and is also affiliated with the New York and Philadelphia Rubber groups.

Industrial Rayon and TB&C Plan Merger

Hayden B. Kline, president of Industrial Rayon Corp., Cleveland, O., has announced that the board of directors recently approved a plan for the combination of Industrial Rayon and Texas Butadiene & Chemical Corp. The proposal is subject to the completion of examinations and verifications of both companies now in progress and to the approval of stockholders of Industrial Rayon.

Texas Butadiene & Chemical Corp., a producer of butadiene and other petrochemicals and of high-octane aviation gasoline, has a plant near Houston, Tex., and also has a 30% interest in a synthetic rubber plant now under construction near Marseilles, France. The corporation's consolidated sales for the first 11 months of 1959 amounted to about $38 million. Its principal stockholders are Godfrey L. Cabot, Inc., Carl M. Loeb, Rhoades & Co., Inc., and their associates in New York, N. Y.

The combination will take the form of an acquisition of Texas Butadiene by Industrial Rayon for approximately 1,675,000 shares of common stock of Industrial Rayon. The latter firm has 1,851,255 shares of common stock presently outstanding.

Mr. Kline will become chairman of the board of directors, and John Fennebresque, president of Texas Butadiene, will become president and chief executive officer of the combined company. A meeting of stockholders of Industrial Rayon to pass on the proposal will be called early in 1960.

Cornell Cites Collyer

John L. Collyer, chairman of the board of The B. F. Goodrich Co., Akron, O., was named Cornell University Alumnus of the year at the annual award dinner of the Cornell Alumni Association of New York City and the Cornell Club of New York. He was cited for distinguished service to his "Alma Mater, his country and the peoples of the world."

Collyer, who received an engineering degree from Cornell in 1917, has been a University trustee since 1941. From 1953 until last July he served as chairman of the University's board of trustees. He has also been a member of boards concerned with athletics, development and alumni affairs, and national chairman of the Greater Cornell Fund which raised $12,500,000 between 1948 and 1953.

As a student, he was one of the greatest oarsmen in the history of intercollegiate rowing. In 1957 he presented the school with a new boathouse as a center for University crew and rowing activities. It is considered one of the finest in the world.

In presenting the award, Deane W. Malott, president of Cornell, cited Collyer's contributions to the economy and industrial life of the nation in his capacities as president, chief executive officer, and now chairman of The B. F. Goodrich Co., as director of Morgan Guaranty Trust Co. of New York and of Eastman Kodak Co., among others, as well as his wartime role in the development of synthetic rubber. Also mentioned were Collyer's former chairmanship of the Business Advisory Council of the United States Department of Commerce, his work as a director of the Foundation for American Agriculture, as a former director of The Rubber Manufacturers Association, Inc., and as trustee of the Committee for Economic Development.

Goodrich-Gulf To Make Oriented Polyolefins

L. O. Crockett, president of Goodrich-Gulf Chemicals, Inc., Cleveland, O., recently announced plans to build a new plant for the production of oriented polyolefins in Port Neches, Tex., adjacent to the firm's synthetic rubber facilities. The new plant will initially produce a type of high-density polyethylene not now manufactured in the United States.

Construction of the plant, which will have an initial capacity of 13 million pounds annually, will be started immediately and is scheduled for completion late in 1960. Complete sales service and laboratory facilities will be provided in the new plant. Engineering and construction will be handled by Ralph M. Parsons Co., Inc., Los Angeles, Calif.

Specific characteristics, including outstanding environment stress crack and thermal resistance, are said to have been built into the G-G polyethylene which will be manufactured by a new process based on Ziegler chemistry. This process has been developed during four years of pilot-plant operation and is designed to produce ethylene polymers particularly suitable for use in bottle, pipe, wire and cable applications.

Goodrich-Gulf work on plastic materials has covered the entire range of polyolefins, with special emphasis on polymers of ethylene, propylene, and butylene. This venture is the firm's first into the manufacture of polymers other than elastomers.

B. H. Foster Retires

Boutwell H. Foster, inventor of textile fabrics and process improvements, retired after 42 years of service with United States Rubber Co., Wayne, N. J. He was honored by fellow scientists of the company's research center at a testimonial luncheon. Company officials commended him for his record of 42 patents (an average of one a year since he joined the company in 1917). His laboratory work has created more jobs and brought the company millions of dollars in sales.

Among Mr. Foster's developments are: Asbeston, a fabric used for fire-fighting suits during World War II and for flame-resistant ironing board covers; Fiberthin, a high-impact, tear-resistant fabric for tarpaulins and inflatable "air houses"; and Trilok, a three-dimensional fabric used in the new Astronaut space suits. He is also co-inventor of Laton, a fine elastic clothing yarn.

In recognition of his adaptation of his three-dimensional fabric for use in an artificial lung called the membrane oxygenator, and for other contributions, he was recently appointed a research associate in the surgical research laboratory of the Bronx Veterans Administration Hospital and the Albert Einstein College of Medicine in New York, N. Y.

Many of the textile testing methods and specifications developed by him were later adopted by the American Society for Testing Materials as standards for the industry. Mr. Foster is an active member of the National Academy of Sciences and the Textile Research Institute and serves on the National Research Council's advisory board on Quartermaster Corps research and development.

Mr. Foster was born in 1894. Educated at the Lowell Textile Institute, he received his B.S. degree in 1917. He began working as a laboratory assistant at the U. S. Rubber textile laboratories, Newark, N. J. When the laboratories were moved to Passaic, he became manager of textile research. He joined the research center at Wayne when it opened in 1957.

W. E. Cake, vice president of U. S. Rubber, W. E. Clark, vice president and general manager of the textile division, and L. M. White, director of research and development, spoke at the luncheon. Mr. Foster received a bound presentation volume of his patents.

Mayfield To Lease Plant To General Tire

The town of Mayfield, Ky., is building a rubber plant for long-term lease to The General Tire & Rubber Co., Akron, O. In designing the modern rubber plant, the city authorities and their consulting engineering firm, H. K. Ferguson Co., Cleveland, O., specified that all the mill's drive motors must be able to withstand the exacting requirements of rubber mill service. As a consequence, the electric drive motors will be insulated with silicone rubber. All of the motors are being built in General Electric Co.'s medium and small a.c. motor and generator departments, Schenectady, N. Y.

For the Mayfield plant "open-type" motors will power the mixers, mills, and extruders. They have a special insulation system, called Polyseal, developed by General Electric. Windings are sealed in silicone rubber that can stand high electrical stress and heat. The plant will use 11 squirrel-cage induction motors ranging in size from 60 to 600 horsepower.

Located about two miles north of Mayfield on U. S. Highway 45, the plant will have more than half a million square feet of floor area. It is expected to be in partial operation by November, 1960. It is expected ultimately to employ about 1,000 persons and to be the city's largest single industry.

Sun Rubber Gets Money To Make Vinyl Items

New capital of $2,750,000 is being provided The Sun Rubber Co., Barberton, O., which expects to resume ful-scale operation as a manufacturer of vinyl toys, dolls, industrial products, and athletic balls as soon as possible.

The money is being provided by the Cleveland, O., investment house of McDonald & Co. in conjunction with The McNeil Machine & Engineering Co., Akron, O. The new capital will enable Sun Rubber to pay all of its creditors in full and leave adequate working capital for operations.

Sun's experience in the development and marketing of vinyl products will be supplemented by McNeil's knowledge of machinery. The refinancing of the firm is expected to permit it to reap the rewards of its long inventive and development program in the field of rotationally cast vinyl products.

Several months ago the United States Circuit Court of Appeals in Cincinnati upheld the validity of Sun's basic vinyl process and machine patents. Sun believes that these patents have important applications, not only in making toys and dolls, but also in many other commercial and industrial products.

T. W. Smith, Jr., will continue as president of Sun Rubber; while Charles F. Safreed, president of McNeil, becomes Sun's chairman of the board.

Expands Topeka Unit

The Goodyear Tire & Rubber Co., Akron, O., plans a $4 million expansion of earthmover tire production facilities at its Topeka, Kan., plant. Tire building equipment will be installed in a new building, measuring 350 feet by 100 feet, by 1961.

Prime reason for the move is to increase capacity to manufacture larger tire sizes, although it will also increase earthmover tire capacity substantially. Goodyear's new facilities will accommodate the maximum tire sizes presently anticipated by the construction equipment industry. The largest sizes will measure close to 10 feet from tread to tread and three feet from sidewall to sidewall.

Production facilities have been expanded at Goodyear's metal products plant in Akron, to build larger rims for the new earthmover tires. Goodyear announced last year it had installed tire building machinery in Akron to manufacture tires weighing two tons and measuring four feet wide and 10 feet high.

Demand for earthmover tires in the United States, stimulated by the National Highway Act and a general increase in construction activity, continues to rise, but foreign demand is said to be increasing even faster.

Ameripol Black Masterbatch Aids Camelback Production and Quality

Edward Malone, general manager of Washington Rubber Co., checks gage uniformity of Ameripol 4654 black-masterbatch camelback

Successful experience with a new high dispersion SBR carbon black masterbatch in the production of heavy-duty camelback is giving strong indications that by the end of 1960, Washington Rubber Co., Washington, Pa., will convert its entire operation to the use of this masterbatch, according to Edward L. Malone, general manager of the company.

Several advantages have been realized by using this SBR Ameripol Micro-Black Masterbatch 4654, which is a rosin soap emulsified cold SBR containing 52 parts of ISAF carbon black and which was developed by Goodrich-Gulf Chemicals, Inc., Cleveland, O. The use of Ameripol 4654 in the production of heavy-duty camelback has resulted in eliminating one weighing operation, reducing the mixing time, making scorch retarders unnecessary, facilitating processing in both the internal mixer and at the extruder, and enabling Washington Rubber to produce up to 30% more of a superior-quality stock than when the rubber and the black were dry mixed separately.

When the SBR and carbon black are handled separately, each requires a weighing operation and then the rubber and the black require a 7½-minute mixing cycle in an internal mixer for each 300-pound batch, followed by a five-minute mixing cycle during which the curing agents are added. During the second cycle the temperature of the mix has to be held below 250° F. to prevent scorching, and adding a scorch retarder is costly and time-consuming.

With the Ameripol 4654 masterbatch, mixing time was reduced from a total of 12½ minutes to 9½ minutes because the first cycle took only 4½ minutes. The amount of power saved is proportional to the reduction in mixing time, and when the plant is fully converted to the use of black masterbatch, substantial power savings are foreseen.

Because there is less heat build-up in mixing the masterbatch, scorch retarders are unnecessary. Also, a more constant Mooney viscosity of the mixed stock is obtained.

Another processing advantage is that with the Ameripol 4654, a more consistent gage is produced at the extruder because there is less die swell, and production volume is greater because there is less rejected material to be reprocessed.

It is reported that the tensile strength of the camelback vulcanizate made from the SBR black masterbatch is 3600 psi., as compared with the 3200-psi. tensile obtained with the dry mixed rubber and black. In addition, retreaders using the camelback made from the SBR black masterbatch have reported to Washington Rubber that wear performance equal to that of new tires is being obtained. Since the toughness of tread stock and its road wear are related to the quality of the dispersion of carbon black in rubber, the more uniformly dispersed black in the SBR masterbatch improves the wearing qualities of the camelback made from it.

Goodrich-Gulf's mixing technique, which is accomplished by high shear agitation of the SBR latex and carbon black slurry immediately before coagulation in the synthetic rubber plant, is said to disperse the black more uniformly and intimately than can be done by dry mixing.

When conversion of Washington Rubber's heavy-duty camelback production to the use of the Ameripol 4654 black masterbatch is completed, crowded warehouse conditions will be alleviated since the masterbatch will occupy less space than the rubber and the black stored separately. More particularly, a cleaner atmosphere both in the warehouse and the plant will result from the elimination of the handling and processing of the carbon black.

General Tire Opens Uvalde Test Track

The General Tire & Rubber Co., Akron, O., officially opened on January 19 its new oval tire testing track near Uvalde, Tex. The new 8½-mile, two-lane speedway was designed by the firm's central engineering division to road-test automobile tires on an outer banked lane at speeds as high as 200 mph., and truck-bus tires on an inner lane at more moderate speeds.

Over all, the track is 44 feet wide on an eight-inch compacted base with a rock-asphalt top surface. The lanes are enclosed by a deer fence on either side. Curves on the track are so gradual that an 18-inch elevation on the outer lane permits 85 mph. "hands off the wheel" testing with no side thrust the entire distance around the oval, reports the company.

Service facilities at the Uvalde site include a 3,000-square-foot office building and an 8,000-square-foot garage for the truck and automobile fleet. The new testing grounds represent an initial investment of a half-million dollars. Future plans include provisions for off-the-road and farm-equipment tire-testing facilities.

General will be testing tires at the new track in the top speed ranges of today's vehicles, to 125 mph. and above. Constant tire checking will give advance warning to the professional test drivers of any pending tire failure.

The company is centering road-testing of all highway tires at Uvalde because of ideal climatic conditions and the complete scientific control possible with a private track and because of the fact that there is no restriction on speed on this track.

Aerial view of General Tire's Uvalde test track

I. Drogin J. F. Bahm C. W. Snow R. Matthews

United Carbon Realines Sales and Service Personnel, Creates Marketing Committee

In line with previously announced expansions and relocations of marketing functions, M. M. Bump, executive vice president, United Carbon Co., Inc., New York, N. Y., has further announced the formation of a marketing committee made up of members of the new marketing operation from the New York, Houston, Tex., and Akron, O., offices.

The new moves are designed to speed up product development, improve delivery schedules, intensify laboratory and field technical service, and provide broader personal service to customers.

Members of the new marketing committee include: John F. Bahm, manager, international sales, located in New York; James A. Boyle, manager, carbon black and rubber sales, also in New York; Harry Bowen, manager, distribution, stationed in Houston; Frank O. Holmes, Jr., manager, laboratory technical service, with office in the Akron laboratory; Russ Matthews, manager, advertising and public relations, operating in New York; James A. Myers, manager, national account sales, headquartered in Akron; and Carl W. Snow, manager, field technical service, also in Akron. Appointed as advisors to the committee were: Ely Balgley, manager, market research; and Isaac Drogin, senior technical advisor, both in New York.

The new international sales manager, Bahm, has spent much of his life abroad. A graduate chemist from L.S.U., Bahm spent 12 years with General Electric prior to joining United. He was formerly manager of new products and commercial development.

Boyle, previously sales coordinator, will direct domestic sales of carbon black and rubber. All district sales managers will report to Mr. Boyle. He was formerly associated with Armstrong Rubber Co.

Bowen, now manager of distribution, was formerly materials control manager for United Rubber & Chemicals Co., the manufacturing division of United. With headquarters in Houston, he will direct both domestic and international order processing, traffic, and shipping.

Holmes will be in charge of the new technical laboratory to be completed early this year in Akron. He was associated with the W. J. Voit Rubber Co., Armstrong Rubber Co., and Goodyear Tire & Rubber Co. before joining United. His experience includes factory managership and technical direction, with some overseas service.

Matthews has spent 28 years in advertising and marketing and will direct activities in these fields for United and its subsidiaries. He was formerly with Union Carbide Plastics Co., serving as manager of marketing for the vinylfoam division.

Myers will coordinate sales and service to multiple plant customers in his capacity as national account sales manager. He has been in charge of the Akron office for the past four years and has had 14 years' sales experience with United. His brother, Fred Myers, will succeed him as head of the Akron district sales.

The new manager of field technical service, Snow, was previously manager of sales service. He has had more than 25 years of experience in research, development, and production of carbon black. He will be responsible for the development of a national network of field technical service personnel.

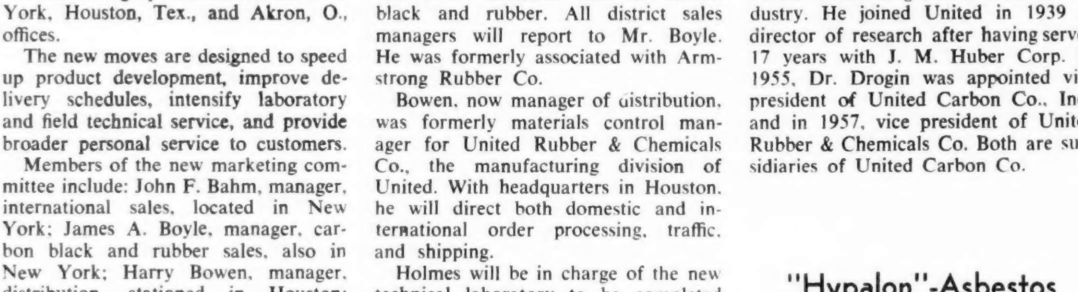
Market research will be under the direction of Balgley, who has had prior experience in this field with Wyandotte Chemicals, General Electric, Heyden-Newport, and General Foods.

Technical advice will be available to the committee from Dr. Drogin, who was appointed to a special advisory post by Mr. Bump. A veteran of 38 years in the carbon black industry, Dr. Drogin is considered one of the outstanding scientists in the industry. He joined United in 1939 as director of research after having served 17 years with J. M. Huber Corp. In 1955, Dr. Drogin was appointed vice president of United Carbon Co., Inc., and in 1957, vice president of United Rubber & Chemicals Co. Both are subsidiaries of United Carbon Co.

"Hypalon"-Asbestos Sheet Packing

A new sheet packing that combines the performance features of "Hypalon" synthetic rubber and asbestos is now available for use where chemical exposure has created problems of expense, excessive maintenance, or interruption of processing.

Keasbey & Mattison Co., Ambler, Pa., has succeeded in combining the outstanding chemical, ozone, and aging resistance of "Hypalon" with the strength, inertness, and economics of



E. Balgley J. A. Myers F. O. Holmes J. A. Boyle H. Bowen

asbestos. "Hypalon," used as the base for the packing, shields the asbestos from chemical contact, greatly increasing wear life, reports the company. In laboratory and field tests, the new material has shown superior resistance to inorganic acids, such as sulfuric, hydrochloric, and pickling solutions, as well as organic acids, aromatic hydrocarbons, and general alkalies such as caustics.

The packing is not subject to cold flow under compression, it is said. Because of the elastomeric nature of "Hypalon," the packing has good flexibility for convenience in installation and does not become brittle under exposure. Compressibility runs approximately 20% and recovery a minimum of 40%. Contamination of process streams is no problem because of the inertness of both "Hypalon" and asbestos.

The material is designed for such uses as gasketing on flanges, condenser heads, columns, hand and manholes, and pump casings. The packing is available in five thicknesses, from 1/64- to 1/8-inch, in sheets 50 by 50, 50 by 150, and 150 by 150 inches. The sheet packing, designated Style No. 903, is manufactured by Keasby & Mattison Co.

"Hypalon" is a product made by the elastomer chemicals department, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

Canadian Companies Join To Make Footwear

British Rubber Co., Ltd., Lachine, P.Q., a division of Mailman Corp., Ltd., and Miner Rubber Co., Ltd., Granby, P.Q., have discussed the establishment of a jointly owned and equally controlled manufacturing organization to produce waterproof footwear under British, Miner, and Hood brands.

When the new company is formed, directors will be A. Stuart McLean, John W. H. Miner, Edward G. Wellheiser, and Noel A. Austin. Starting early in 1960, a portion of British Rubber Co. footwear will be manufactured at the Granby factory. Both British and Miner will continue their separate identities and will market their own products and brands independently through their separate sales organizations' head offices and warehouses.

The Lachine factory of Mailman Corp. will continue to manufacture slippers, canvas casuals, and molded footwear, plus other products, and a substantial expansion of these operations is seen.

Miner Rubber Co. will continue to manufacture mechanical and other products such as vulcanized industrial work clothing and gloves. The company will also continue its operations as custom proofer.

Sponge-Spike Roll Removes Wallpaper

Open-cell sponge rubber has helped a small chemical specialty company to solve a rather difficult penetration problem. The company, North Shore Laboratories, Salem, Mass., had developed a product, "Take Off," for removing wallpaper or other coverings. It would work on plastic coated or painted papers if it could be worked under the surface.

The partners in this company found a way to enable the fluid to penetrate the surface and act on the adhesive by inventing a device similar to the common paint roller. Under the open-cell sponge layer which holds the fluid are spikes. The sponge compresses when in contact with the wallpaper, allowing the spike to create a hole in the paper through which the fluid deposited can seep and attack the adhesive.

The device is patented, but the inventors do not expect to manufacture it themselves. They have indicated a desire to license this mechanical portion of the remover combination.

Dayton Helps Tire Firm in India

Two Dayton Rubber Co. executives recently joined Prime Minister Nehru and other officials in cornerstone ceremonies for a new tire plant in Cochin, Kerala, India.

Representing Dayton at the ceremonies were A. L. Freedlander, chairman of the board, and Richard Rosenberg, manager of the firm's international division. Dayton Rubber recently entered into an agreement with a group of private Indian investors together with the government of Karala to supply all the technical assistance necessary for the construction and operation of a $4.5 million tire plant in Cochin. The plant is expected to go into production by the middle of 1961 and will turn out Dayton-brand tires as a result of a licensing agreement.

Dayton Rubber is one of the first U. S. companies to be called upon to assist in the industrial development of Kerala. Kerala, located in the southern tip of India, has the reputation of being the most literate state in India, but has been plagued with serious problems of unemployment.

The Indian firm will be known as Premier Tires, Ltd. The plant will produce mostly truck tires for the domestic market.

Witco Expands Abroad

Corporate and organizational changes preparatory to a sharp step-up in Witco Chemical Co.'s European expansion program have been announced by William Wishnick, Witco executive vice president in charge of international activities.

Operations both in England and on the Continent include: (1) acquisition of minority interests in its English subsidiary, Witco Chemical Co., Ltd.; (2) election of Cuthbert C. Hallett, managing director of the English subsidiary, to the parent company's board of directors; and (3) election of Robert Shacklady to joint managing director of the English subsidiary.

Witco Chemical Co., Ltd., is a custom compounder of natural and synthetic latices and worldwide distributor of other chemical products. Its headquarters are in London, with a plant in Droitwich, England, and sales offices in London and Manchester, England; Glasgow, Scotland; and Rotterdam, Netherlands. The Rotterdam office was opened October, 1959, to serve as headquarters for the distribution of carbon black which is produced in the Netherlands by an affiliate of Witco.

Another recent development in the English firm's expansion was the organization of a French subsidiary—Witco Chemical France—for the distribution of carbon black produced at Bordeaux, France.

Students

(*Continued from page 694*)

Stiehler, NBS, and was sponsored by The Washington Rubber Group.

The lectures were held at 7:30 p.m. in the Department of Commerce Auditorium on Tuesday evenings, starting January 12. Mr. Flanagan spoke on February 2 and Dr. Stiehler on February 9.

High Polymer Forum

The Tenth Canadian High Polymer Forum will be held at the Alpine Inn, Ste. Marguerite, P.Q., Canada, on September 8-9. The Forum, sponsored by the National Research Council of Canada in cooperation with the Chemical Institute of Canada, is devoted to all aspects of polymer science.

The chairman of the Forum is L. A. McLeod, research and development division, Polymer Corp., Ltd., Sarnia, Ont. Authors wishing to submit papers for presentation at the Forum are asked to write to the program chairman, Dr. K. E. Russell, Department of Chemistry, Queen's University, Kingston, Ont. Titles are required by May 1, and abstracts of approximately 300 words by June 30.

NEWS BRIEFS

J. O. ROSS ENGINEERING DIVISION, Midland-Ross Corp., recently broke ground for its new offices at 13050 Puritan Ave., Detroit, Mich. The new building, scheduled for February completion, will house engineering and office personnel of Ross, plus representatives of Midland-Ross. The division designs, fabricates, and installs air-processing systems used in industrial heating, drying, and curing operations in such diversified fields as metal finishing, paper, rubber, plastics, automotive, textile, and foundry.

B. F. GOODRICH CHEMICAL CO. reports what is said to be the installation and operation of the first computer control system in the chemical processing industry, at its Calvert City, Ky., plant. The computer, an RW-300 system engineered and manufactured by Thompson-Ramo-Wooldrige Products Co., is being used to operate more efficiently a process for producing vinyl chloride monomer by cracking ethylene dichloride. The computer responds instantaneously and accurately to any variable which may occur in the process and knows exactly what adjustments to make to continue to operate the process at maximum efficiency.

McCREARY TIRE & RUBBER CO., Indiana, Pa., has announced a complete new line of passenger tires made with Tyrex viscose cord. The company reports that the viscose cord used in the tires provides longer, safer mileage because of its outstanding ability to resist the road shock and impact encountered at current high speeds and heavy loads. The cord's extra durability makes repeated retreading possible for even greater economy. Complete information on this new line of tires is available from the company.

THE BATA SHOE CO. OF CANADA, LTD., Batawa, Ont., Canada, plans to open soon a division for the manufacture of soles, according to Mayor F. M. Rutherford. The current staff of 80 will be increased to about 120 when the 8,000-square-foot addition to the plant begins operations. The firm now manufactures only shoe uppers. The present building was constructed for the company in 1956.

ST. JOSEPH LEAD CO., New York, N. Y., has appointed Harwick Standard Chemical Co. of California, 1248 Wholesale St., Los Angeles 21, Calif., sales representative for St. Joe lead-free zinc oxides in the entire State of California. Harwick will maintain warehouse stocks of the zinc oxides in Los Angeles and San Francisco to serve less-than-carload customers. Carload shipments will continue to be made directly from Josephtown, Pa.

HOUDRY PROCESS CORP., Philadelphia, Pa., has announced a new commercial price schedule for Dabco, a catalyst for producing urethane foams, coatings, and elastomers, following the commercial start-up of a new Dabco plant in Paulsboro, N. J. The new plant was built to meet the large market demand for Dabco's use in one-shot polyether processes, which has resulted in substantial process economies and simplification of urethane foam production, reports the company. The new Dabco plant is now fully operational.

THE CARWIN CO., North Haven, Conn., absorbed its wholly owned subsidiary, Carwin Polymer Products, Inc., effective December 31, 1959. The business of developing, manufacturing, and marketing products previously carried on by the subsidiary will now be conducted by The Carwin Co., polymer products division, whose personnel remains unchanged.

MINNESOTA RUBBER CO., Minneapolis, Minn., for the second time in less than a year has announced the completion of a plant expansion. The latest construction, completed on January 1, adds 12,000 square feet in a two-story structure to the company's manufacturing facilities. The first addition, a 30,000-square-foot area, was announced in February, 1959. This expansion brings the total manufacturing area up to approximately 120,000 square feet. The new space will be utilized for the installation of the latest high-speed rubber mixing equipment and 12 electric-hydraulic presses. The continual growth of this firm is attributed to its concentration on producing extremely high-quality parts to very close tolerances.

DUREZ PLASTICS DIVISION, Hooker Chemical Corp., Niagara Falls, N. Y., has opened a new sales office at 333 W. First St., Dayton, O., to serve the Michigan-Ohio district, according to James W. Ferguson, division sales manager. George A. Shroyer, district sales manager, is in charge of this Dayton office, which serves Alabama, Mississippi, Ohio, most of Indiana and Michigan, and parts of Tennessee and West Virginia. Reporting to Shroyer are Donald J. Crain, Robert J. Entenman, Alan G. Hill, George W. Kobel, and Harry C. Shelton. The Detroit office, 1503 Stephenson Building, will operate as a branch office of the Michigan-Ohio district, responsible to Shroyer. His staff at that office includes Kenneth J. Fuoco and John E. Emmett. The sales office formerly located at the Durez plant in Kenton, O., has been discontinued.

THE GOODYEAR TIRE & RUBBER CO., Akron, O., is opening two new field offices to serve vehicle manufacturers at the original equipment level. A new office of Goodyear's manufacturers' sales division was opened at Philadelphia, Pa., on January 1. A similar facility will open at Cincinnati, O., on January 18. Need of the additional field representation has been brought about by the increasing number of manufacturers in the growing trailer, truck, farm machinery, industrial truck, and mobile home and construction machinery fields, reports the company.

NATIONWIDE LEASING CO., Chicago, Ill., reports that long-term leasing of production equipment by rubber manufacturing firms during 1959 spurted ahead, reaching a total of $5.4 million worth of equipment on lease, a gain of 80% over 1958 figures. Robert Sheridan, president of the firm, predicted that equipment leasing in the rubber industry would double in 1960 because of three factors: (1) more equipment manufacturers are using leasing as a sales tool; (2) more companies will lease their equipment to avoid the pinch of tight money; and (3) more companies will be affected by the increasing technological progress which is speeding up obsolescence of machinery.

HERCULES POWDER CO., Wilmington, Del., and IMPERIAL COLOR CHEMICAL & PAPER CORP., Glens Falls, N. Y., have agreed in principle to the acquisition of the business and assets of Imperial in exchange for Hercules stock. If the transaction is completed, the 1,019,604 shares issued and outstanding of Imperial common stock will be exchanged for 509,802 shares of a new class of Hercules stock, to be designated as $2.00 cumulative convertible preferred stock. The acquisition will broaden the present diversification of both companies.

RUBBERMAID, INC., Wooster, O., introduced a new color to the trade at the January Housewares Show at Chicago's Navy Pier. Sandalwood, a fashion neutral, has been adapted to Rubbermaid's complete line. In a national sales promotion, the firm is offering an introductory merchandise assortment in sandalwood to dealers. It will include two each of various styles of drainboard mats and drainer trays, sink divider, sink and stove mats; dishpans, wastebaskets, buckets, dish drainers, sink strainers, cutlery trays, drawer dividers, tissue dispensers, storage bins, bath mats, toilet top trays, soap dishes, and extra silverware cups. The new color has been incorporated into Rubbermaid's color chart as a result of consumer demand. It blends with natural wood cabinets and paneling and contrasts with high shades.

UNION CARBIDE PLASTICS CO., division of Union Carbide Corp., New York, N. Y., recently announced that the increased plant capacity at South Charleston, W. Va., for the production of polyvinyl ethyl ether resins, is now on stream. These resins are said to be the binding force in the family of adhesives that maintain permanent tackiness and bonding strength. Although production figures were not announced, it was said that total output at South Charleston would be measured in millions of pounds annually. A pound of resin can supply a permanent adhesive to an area as great as 35,000 square inches.

ASSOCIATED TESTING LABORATORIES, INC., environmental testing laboratory and manufacturer of environmental test equipment, will move into a new plant in Wayne, N. J., early this year. The new 30,000-square-foot building, estimated to cost approximately $500,000, will be situated on a five-acre plot on Route 46 near the intersection of Route 23. This one-story, air-conditioned structure, designed by Holley & Johnson, industrial architects, will be constructed and leased by Weny Bros. & Storms Co. Extra acreage will provide about 40,000 additional square feet for future plant expansion.

CORTLAND INDUSTRIES, INC., Chicago, Ill., one of the nation's major fabricators of plastics, vulcanized fiber, and paper specialties, has purchased the former plant of Groen Mfg. Co. at 4545 W. Armitage Ave., Chicago, and is remodeling the 60,000-square-foot building. Cortland was expected to occupy the new building about February 1, placing all of its vacuum-forming facilities there. The new facility replaces the firm's previous vacuum-forming plant. New equipment will include a $60,000 extruder, pump presses, and sawing machinery.

CHEMICALS & PIGMENTS CORP., Newton, Mass., has been appointed to handle the New England distribution of the extensive lines of organic pigments and oil- and spirit-soluble dyes manufactured by the dyestuff and chemical division, General Aniline & Film Corp., New York, N. Y. This appointment will add considerable sales effectiveness for these products in the Northeast, and the combined resources of both companies will offer customers in the pigment-consuming industries increased technical assistance and also provide prompt, efficient deliveries from the dyestuff and chemical division's Providence, R. I., warehouse.

WESTERN PETROCHEMICAL CORP. reports that expansion of existing facilities and construction of additional process units at its Chanute, Kan., refinery are nearing completion and are expected to go on stream this month. The additional facilities include a propane deasphalting unit, additional vacuum distillation units, and a TCP wax treater process unit, said to be the first of its kind. The TCP unit will provide continuous bleaching of wax products instead of the conventional batch bleaching.

ESB-REEVES CORP. has commenced development for pilot-plant operation in newly acquired facilities at 323 W. Glenside Ave., Glenside, Pa., according to The Electric Storage Battery Co. and Reeves Brothers, Inc., joint owners of the firm. The new company is responsible for the development of all processes and products related to microporous plastic materials and the marketing of all such materials. It is under the direction of Howard J. Strauss, vice president and general manager, who reports to D. N. Smith, vice president of both The Electric Storage Battery Co. and EBS-Reeves Corp.

THE FIRESTONE TIRE & RUBBER CO.'S home and auto supply division, Akron, O., recently observed its twenty-fifth anniversary. The start of such a division seemed a natural expansion move for the company in 1934. Dealer stores and the company's own chain of one-stop service stores—selling tires, gasoline, oil and auto services—had been operating for many years. Today trained specialists in the department are responsible for the purchase and merchandising of more than 6,000 separate items sold through the nearly 800 Firestone stores and thousands of dealers. The company's complete line includes all major appliances, housewares, hardware, paint, lawn and garden supplies, wheel goods, recreation supplies, toys and televisions, in addition to everything for the car from air filters to windshield wipers.

NAUGATUCK CHEMICAL DIVISION, United States Rubber Co., Naugatuck, Conn., has developed a self-curing latex compound for carpet backing which is said to have exceptional heat and light-aging characteristics and will not stain carpet facings or cause odors. The new material, called Lotol L-4634, can be cured by merely drying, thus eliminating high-temperature curing. The absence of conventional curing chemicals from the compound improves odor and heat and light discoloration qualities. The new compound is said to save processing steps because it is a one-package system. In most applications there is no need of adding plastic latices or hard resin extenders to improve hand. Used with ordinary fillers, Lotol L-4634 gives a high-strength, full-bodied hand with good resilience and resistance to deformation.

TEXAS-U. S. CHEMICAL CO., New York, N. Y., manufacturer of a complete line of SBR's, has opened a new southern district sales office at 1612 W. Alabama St., Houston 6, Tex. The new office will service customers in Kentucky, Tennessee, Alabama, Mississippi, Louisiana, Arkansas, Oklahoma, and Texas. Heading up the new office as district sales manager will be L. E. Stanton, who has ten years' experience in the rubber and chemical industry.

STAUFFER CHEMICAL CO., New York, N. Y., has acquired the Plastic Pipe & Tube Division, Anesite Co., Santa Barbara, Calif. The Anesite pipe production facilities have been moved to Vernon, Calif., and are now operating as a unit of Stauffer's molded products division. Under the terms of the acquisition, Anesite is providing Stauffer with its complete know-how in the extrusion of plastic pipe, tubes, and special shapes. Stauffer is also licensed to produce and sell under the Anesite brand names. In turn, Stauffer has appointed Anesite a sales agent in the western states for plastic pipe, tube, fittings, and custom extrusion. Also, Stauffer plans to produce and sell proprietary and customer-brand extruded products as well as a new line of PVC pipe and tubing.

CADILLAC PLASTIC & CHEMICAL CO., Detroit, Mich., a division of Dayton Rubber Co., has purchased the Akron warehouse and inventory of Plastics Mfg. & Supply Corp., Cleveland, O. The acquisition gives Cadillac Plastic its thirteenth regional warehouse. It previously operated a sales office in Akron. Cadillac Plastic is one of the nation's largest plastics warehousers and a principal manufacturer of plastic warehouse shapes. Philip G. Rath has been promoted from representative in charge of the Akron sales office to Akron branch manager.

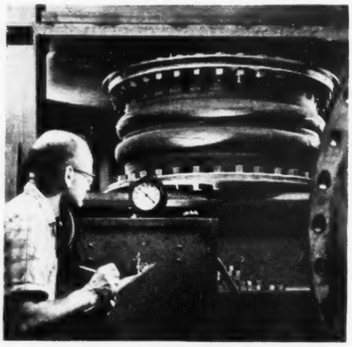
News Briefs

THE RICHARDSON CO., Melrose Park, Ill., a leading producer of industrial rubber and plastics products, has acquired for cash a majority interest in Plastics Corp. of America, Stamford, Conn., according to William B. Basile and Carl J. Luster, presidents of the two companies. The acquisition will provide diversification of Richardson into the plastic materials field and will give it a manufacturing and marketing outlet for new products expected from its recently expanded research and development division. Plastics Corp. of America is a relatively new polystyrene producer, having just completed a new, modern plant, producing thermoplastic materials for the plastics fabricating industry. A unique feature of its plant provides the company with exceptional flexibility for the production of styrene copolymers, graft polymers, and other specially modified styrene thermoplastics.

McKESSON & ROBBINS, INC., New York, N. Y., has been appointed a national distributor of Monsanto Chemical Co.'s styrene monomer in drum quantities, according to Monsanto's plastic division, Springfield, Mass. The agreement does not affect shipments of the monomer to Monsanto's tank-car and tank-truck customers or to its own polymer producing plants. Such shipments to large-volume users in the plastics and synthetic rubber industries will continue to be made from Monsanto's plastics division styrene monomer plant at Texas City, Tex., and its three distribution points at Addyston, O., New Haven, Conn., and Long Beach, Calif.

THIOKOL CHEMICAL CORP.'S chemical division, Trenton, N. J., has announced a new national advertising, promotion, and information program, designed to acquaint the boating industry and individual boat owners with the properties and advantages of calking compounds based on polysulfide liquid polymer. The campaign will be aimed at builders, yard owners, and boat owners. The polysulfide materials are said to dry immediately after application to a resilient rubber that bonds for many years to joints and seams. Two of the major boat builders have already made extensive use of polysulfide sealants in the construction of their cruisers, and several more have the compounds under study, reports the company.

GOODYEAR TIRE & RUBBER Co.'s research executive, J. D. D'Ianni, told a recent American Chemical Society regional meeting that it is becoming increasingly difficult to classify a new polymer as a rubber or a plastic. D'Ianni reported that it becomes easier to fit a specific polymer to a specific end-use than to decide its classification.



One of a series of Viton-lined neoprene expansion joints is hydrostatically tested at The Garlock Packing Co., Palmyra, N. Y. The double arch joints are located in exhaust lines carrying turbine steam to condensers in Navy nuclear submarines. The carcass of the joints is fabricated of neoprene, and sizes include 42-inch I.D. by 24-inch face-to-face and 26-inch I.D. by 24-inch face-to-face. The joints are asbestos reinforced with internal steel body rings. The Viton liner, specified because of its lack of chlorine ions, is adhered to the carcass bv a special process developed by Garlock.

HOOKER CHEMICAL CORP.'S combined Los Angeles sales offices of both the Durez Plastics and Western Chemical divisions have been relocated at 6277 E. Slauson Ave., Los Angeles 2, Calif. The telephone number is Overbrook 5-8910. These offices are to be consolidated with modern warehouse facilities for the company's products in the new warehouse of Interamerican Warehouse Corp. at this location, where all company stock for the area will be stored henceforth.

RUBBER & ASBESTOS CORP., Bloomfield, N. J., manufacturer of industrial adhesives, has signed an exclusive licensing agreement covering the manufacture and distribution of a diversified group of its solvent-dispersed industrial adhesives in Mexico with Adhesivos Resistol, S.A., Calzada Atzcapotzalco- Villa 702, Mexico 15, D.F., prominent adhesives manufacturer of that country. The R&A adhesives to be manufactured in Mexico include Bondmaster products for the bonding of ceramic and acoustical tiles; rigid foamed polystyrene, polyethylene film and other vapor barrier and insulating materials; tack-free flexible foam adhesives for furniture manufacture; tire retread cements; pressure-sensitive adhesives; laminating, combining, and flocking adhesives; and a wide range of general-purpose formulations.

EASTMAN CHEMICAL PRODUCTS, INC., New York, N. Y., recently announced four industrial inhibitors which it will soon market. Eastman chemists first announced the chemicals in a research paper presented at a recent conference of the Society of Plastics Engineers. Labeled Eastman Inhibitors HPT (hexamethyl-phosphoric triamide), RMB (resorcinol monobenzoate), OPS (p-octylphenyl salicylate), and THBP (trihydroxy-butyrophenone), these chemicals are presently available in development quantities. The first three are expected to find use as ultraviolet stabilizers for synthetic resins such as vinyls, cellulosics, polyesters, and polyolefins. The butyrophenone derivative shows excellent promise as an antioxidant for polyolefins and paraffins.

UNITED STATES RUBBER CO., New York, N. Y., has developed a new, shock-absorbing, but tough tread rubber that is said to give tires a smoother, quieter ride and up to 25% more mileage than tires made with the old, hard rubber tread stock. Two major engineering improvements in the processing and curing of tires by the company made it possible to adopt the new compound. The improvements are advanced Bag-O-Matic curing machines which place less strain on the raw tire during the shaping process, and pressure tempering, a method of relaxing the tire after it has been removed from the mold. U. S. Rubber's new replacement and original-equipment tires for the 1960 cars have the new rubber in the tread.

LEWIS-SHEPARD PRODUCTS, INC., Watertown, Mass., manufacturer of electric-powered fork lift trucks and related products, has introduced a new series of special roll handling dollies with built-in turntables for handling huge press rolls and intermediate calender rolls through plants. The units have capacities ranging frcm 8,000 to 20,000 pounds each. Built into the dolly is a free swiveling turntable. On the top of the turntable is a plate 10 inches wide by 30 inches long in which are drilled slotted holes. The calender rolls are bolted to these plates to assure maximum stability during transportation operations.

THE TIMKEN ROLLER BEARING CO., Canton, O., recently announced a guarantee of Timken bearing prices to its original-equipment manufacturing customers for production purposes for the calendar year of 1960. In making the announcement, P. J. Reeves, vice president in charge of sales, said that the price guarantee was made despite the fact that the company is presently negotiating a new contract with the United Steel Workers of America, the results of which are uncertain.

Now available—
exceptional non-staining properties in all...

POLYSAR KRYNACS

The non-staining properties of Polysar* Krynac (nitrile) rubbers have been markedly improved and the raw polymer colour has been lightened. These improvements, together with the inherent advantages of easy processing and relatively low water absorption, provide the best balance of properties in oil resistant rubbers.

Polymer Corporation Limited has been producing Polysar Krynac . . . "cold" nitrile rubber . . . since 1949. This production experience is unmatched by any other supplier. The current program of polymer improvement emphasizes their leadership in the field.

Many applications requiring varying degrees of oil resistance have been launched by the adoption of one of the Polysar Krynac types. In the past these have usually been black compounds. More recently compounders have turned to Polysar Krynac as the base polymer for coloured compounds—notably in the development of oil and heat resistant industrial shoe soling and smooth, flame-resistant cable jackets. In both black and coloured compounds Polysar Krynac has improved the product quality and reduced production costs.

Information detailing light coloured and black compound applications is available in over 40 Polysar Technical Reports. Tell us about your product development plans and we will send you appropriate literature and the name of the Polymer representative near you. Write to: Marketing Division, Polymer Corporation Limited, Sarnia, Canada.

*Trade Mark Registered

POLYSAR Krynacs

POLYMER CORPORATION LIMITED
SARNIA, CANADA

See overleaf for striking results of comparison tests under sun-lamp exposure.

PHILLIPS PETROLEUM CO., Bartlesville, Okla., has licensed its carbon black process to be used by a plant which will be constructed in Japan by Showa Denko, K.K., according to Massao Anzai, president of Showa Denko, and K. S. Adams, chairman of Phillips. The Japanese firm has been licensed to use Phillips' process for producing oil furnace black, used widely by the rubber industry in the manufacture of tires and other products. Design work on the new plant is also being done by Phillips. The plant is expected to be in operation within two years.

UNITED STATES RUBBER CO., New York, N. Y., has introduced its new line of Elastic Naugahyde for furniture upholstery, called Chromata, that is smooth and very supple with a rich look and dull finish. Chromata is named for its 20 exciting colors, which include high-fashion home furnishings colors, as well as basics. They are: smoke grey, opal white, absinthe green, royal blue, antique gold, empire green, mocha, regal purple, bronze green, citron, cerulean, marigold, sand, espresso brown, regimental red, russet, azure blue, vermilion, white, and black. Elastic fabric backed and 54 inches wide, Chromata will tailor easily and give exceptional wear, reports the company.

AVISUN CORP., Philadelphia, Pa., has announced the commercial production of Olefane, high-clarity high-strength polypropylene film for packaging applications. Manufacturing facilities located at New Castle, Del., have a capacity of 10 million pounds per year and will produce film from one through four mils thickness for general packaging usage and sheets from four to twenty mil thickness for thermoforming. Olefane is offered in rolls from 2½ to 60 inches in width. It can be treated for printing or left untreated and produced with either low slip or high slip coefficient of friction properties.

THE GOODYEAR FOUNDATION has awarded $2,000 to the Texas Foundation of Voluntarily Supported Colleges and Universities. Goodyear Foundation is a tax-exempt charitable foundation supported by contributions from The Goodyear Tire & Rubber Co. Goodyear Foundation in 1959 provided $161,000 in grants and scholarships to many higher-education institutions throughout the United States. Direct grants-in-aid to schools and to foundations of independent colleges totaled $116,000. In addition to scholarship grants of $1,000 per student, each school participating in the program receives an unrestricted grant-in-aid to help offset administrative and other costs not included in the tuition.

E. I. DU PONT DE NEMOURS & CO., INC., Wilmington, Del., in its annual aid to education, has awarded grants totaling more than $1,300,000 to 143 universities and colleges. The program is for fundamental research by universities, for strengthening the teaching of science and related subjects, and for facilities for education or research in science and engineering. Grants totaling more than $580,000 were awarded for the 1960-61 academic year to more than 100 colleges and universities to support teaching activities; for education and research in medical schools; and for post-graduate awards and scholarships. Grants for fundamental research totaled $475,000 for 37 universities. An additional $43,200 was awarded for 24 summer research grants. A $250,000 fund was authorized for capital grants for science and engineering facilities.

W. L. GORE & ASSOCIATES, INC., Newark, Del., has developed a fast, simple method of bonding Teflon to itself and to other materials. Basis of the new system, called Tetra-Etch, is an active form of sodium in solution. Tetra-Etch reacts with Teflon to form a carbonaceous film on the treated surface. This film then serves as a means of anchoring adhesives to the Teflon. The compound has proved compatible with a variety of adhesives, including epoxies, phenol formaldehydes, and most of the rubber and silicone types. The etchant has proved effective on Du Pont's new Teflon 100X (FEP-fluorocarbon resin) as well as on the more widely used TFE type. The material is normally packaged in two-ounce bottles, but larger sizes are available from the company.

THE BORDEN CHEMICAL CO. has announced the initial production of acrylic emulsions in a new manufacturing plant at Demopolis, Ala. The new unit, Borden's first in the South, will add substantially to the firm's existing production capacity for these products. A leader in the acrylic emulsion field, Borden Chemical also operates similar manufacturing facilities at Leominster, Mass., Illiopolis, Ill., and Compton, Calif. Acrylic emulsions are used extensively in the paper, leather, paint, and textile industries.

AMERICAN CHEMICAL CORP. recently established headquarters in its newly completed office building at 2112 E. 223rd St., Long Beach, Calif. The general offices are on the site of the West Coast's newest petrochemical plant which will go on stream early in 1960 to produce chlorinated hydrocarbons and polyvinyl resins. Some 50 employes have already begun work at the new location. American Chemical Corp. is jointly owned by Richfield Oil Corp. and Stauffer Chemical Co.

MERCK MARINE MAGNESIUM division, Merck & Co., Inc., Rahway, N. J., reports that increased adoption of synthetic rubber in European industry has prompted it to expand international distribution there. The division's products will be available through the following six European firms: Atlantic Trading Co., Brussels, Belgium; O/Y Uko A/B, Helsinki, Finland; S.E.C.C.A., Paris, France; Nordmann, Rassmann & Co., Hamburg, Germany; Bubeck & Dolder, Basel, Switzerland, and Croxton & Garry, Ltd., Surrey, England. At present Merck supplies industry with seven types of magnesium compounds.

WESTERN PETROCHEMICAL CORP.'S polymer division has completed research and development laboratory facilities at Chemical Industries Park, Newark, N. J., according to Norman G. Gaylord, research and development vice president of the division. The laboratories will be under the direction of Dr. Gaylord. The expansion will enable the division to broaden and intensify its existing research and development programs at adapting polymer technology to waxes and wax products.

GOODYEAR TIRE & RUBBER CO., Akron, O., will introduce a new material for the flooring industry early this year. Dirt-catching, pattern-breaking seams can be eliminated or minimized by the use of the company's first all-vinyl compounded line of six-foot wide roll goods for flooring.

J. O. ROSS ENGINEERING, division of Midland Ross Corp., recently gave special recognition to its employes who have been with the organization 25 years or more. Sixty-seven people attended the fourteenth annual 25-year dinner party held at the Hotel Savoy Plaza, New York, N. Y. This year 10 new members were added to the club directory, bringing to 46 the total number of employes who have had more than 25 years with Ross Engineering.

GATES RUBBER CO., Denver, Colo., officials recently inaugurated the company's second foreign manufacturing plant, in Toluca, Mexico, capital of the State of Mexico. The installation is a $500,000 manufacturing plant which will produce a variety of rubber products including a complete line of V-belts for the automotive and industrial markets in Mexico. The 27,000-square-foot plant, located on a seven-acre plot, is a self-contained operation having its own maintenance shop and water system. The Gates plant will employ about 25 Mexicans. Robert L. Hall, manager of the Gates rubber covering plant in Sioux City, Iowa, for the past three years, is general manager of the new Toluca operation.

NEWS about PEOPLE

THE L. C. MORRIS CO., Atlanta, Ga., has been appointed exclusive sales agent in the southeastern states for Hetron® polyester resins, according to James W. Ferguson, sales manager of the Durez Plastics Division of Hooker Chemical Corp., North Tonawanda, N. Y. The Morris organization will handle Hetron sales in Alabama, Florida, North Carolina, South Carolina, and eastern Tennessee. This sales agent has handled the industrial phenolic resins and molding compounds of the Durez Plastics Division for the past several years.

RUBBERMAID (CANADA), LTD., Cooksville, Ont., Canada, plans an addition to its recently built Cooksville factory, which will almost double the present floor area to about 67,000 square feet.

DUREZ PLASTICS DIVISION, Hooker Chemical Corp., North Tonawanda, N. Y., has announced that its polyester resin, Hetron® 92, has been used successfully in the construction of a rugged 40-foot utility boat for the U. S. Coast Guard service. The boat, which withstood severe service tests by the Coast Guard, was fabricated from the fiberglass-reinforced fire-resistant polyester resin. The boat was built by Chance & Associates, Inc., Waldorf, Md., naval architect and engineer, who has pioneered the design, the development, and the fabrication of reinforced plastics for a number of vessels destined for the United States Navy.

John R. Hodson and **Erhart K. Drechsel** have been appointed associate directors of the development department for Texas Butadiene & Chemical Corp., and **Ernest W. Kirchheimer** has been named senior process economist for the same department. All three will have headquarters in New York, N. Y. Hodson formerly was in the company's process economics and development department; while Drechsel was with Escambia Chemical Corp. Kirchheimer was process engineer at TB&C's plant at Channelview, Tex.

Matthew S. Fox, vice president, Balfour, Maclaine, Inc., New York, N. Y., has been elected a vice president of Commodity Exchange, Inc., New York, for the rubber group. Fox and **Robert A. Badenhop,** president of Robert A. Badenhop Corp., New York have been elected governors for the rubber group. Commodity Exchange, Inc., serves as the market place for futures trading in copper, lead, zinc, rubber, and hides. Its new president is **J. Raymond Stuart,** a general partner of E. F. Hutton & Co.

"Gum Elastic," the original Charles Goodyear treatise, was presented to The Goodyear Tire & Rubber Co., Akron, O., by a descendant of Goodyear's lawyer, Etienne Blanc, of Paris. The attorney's grandson, upon hearing that Goodyear plans to build a tire plant at Amiens, France, brought the book to Goodyear-France and requested it be delivered to E. J. Thomas, board chairman. Shown accepting the book on Thomas' behalf from D. R. Bennett, finance manager, Goodyear-France, who brought it to Akron, is P. E. H. Leroy, *right*, vice chairman of the board. Looking on, *left*, is H. L. Riddle, comptroller, Goodyear International. Handwritten letter from Charles Goodyear to M. Blanc was inserted inside cover and is dated December 13, 1853.

James W. Dannemiller has been appointed production manager for The General Tire & Rubber Co.'s tire plant at Akron, O. Formerly general foreman of processing, Dannemiller succeeds **Robert Rehm,** recently named plant manager of the company's Mayfield, Ky., tire plant, now under construction. In addition, **James P. Plant** becomes general foreman of the processing division, and **M. T. Helmacy** general foreman of single-bead tire building and auxiliary departments. Plant will be in charge of the mixing, extruding, and calendering departments at the Akron plant. He was general foreman of passenger tires.

James R. Anslow has become senior research chemical engineer for Jefferson Chemical Co.'s research laboratories at Austin, Tex. Previously he served as a gas engineer for Magnolia Petroleum Co.

James Harwood has become a research associate in the Institute for Rubber Research and assistant professor of chemistry at the University of Akron, Akron, O. Dr. Harwood comes to the University from the Monsanto research laboratories, Dayton, O.

E. W. Ryan has been appointed superintendent of the latex and reclaim division of Dominion Rubber Co., Ltd., Montreal, P.Q., Canada. Ryan, with Dominion for 31 years, will be responsible for production, services, and industrial relations. **Harold R. Chipman** is now manager of new products development for the general products division of Dominion, located at Kitchener, Ont. He was in charge of plastics development at the Naugatuck Chemicals Division until recently. **H. A. E. Burgess** has been made sales manager, transportation products, for the general products division and will direct the sales of all commodities to the automotive and aircraft industries. **R. D. Shepherd** becomes sales manager, seating products. He will handle Koylon foam, Naugahyde, and Naugaweave vinyl-coated fabrics. **W. H. Wolfhard** has been named sales manager, underlay and floor coverings, for the same division. His products include Carpet Cushion, rug underlay, and sponge-backed Royal-Tex carpeting.

News about People

B. Ainsworth C. A. Church

Bruce Ainsworth has been named president of the Harchem Division, Wallace & Tiernan, Inc., Belleville, N. J., according to **Charles H. Rybolt,** vice president in charge of chemical divisions for Wallace & Tiernan. Formerly assistant to Rybolt, Ainsworth will now be responsible for all division activities, including research, production and sales.

A. H. Knoll, head of the factory service department of Procter & Gamble Co., Cincinnati, O., is now chairman of the mechanical technical committee of the Manufacturing Chemists' Association, Inc., Washington, D. C. He succeeds **D. F. Hollingsworth,** of E. I. du Pont de Nemours & Co., Inc. **P. J. Callan,** Eastman Kodak Co., Rochester, N. Y., is vice chairman. The committee was formed in 1955 to study the need of standardizing chemical manufacturing process equipment and to make recommendations to national standardizing groups.

Michael J. Connor has been assigned to the public relations staff at The Firestone Tire & Rubber Co., Akron, O. Connor has been with the company's advertising department since 1957.

Samuel A. Cooper has been made assistant director, fiber marketing department of National Aniline Division, Allied Chemical Corp., New York, N. Y. **Fred E. Noechel** becomes technical service manager. Cooper was formely sales manager and assistant to the director. Noechel previously held the position of fiber end-use development manager. In addition, **William H. Poisson, Robert E. Mulcahy,** and **D. M. Holsenbeck** fill three newly created positions. Poisson is now manager of planning and evaluation. He was formerly manager of fiber technical service and fiber application laboratory. Mulcahy, recently regional sales representative for New York and New England, has been named regional sales manager for that area. Holsenbeck, who had been southern regional sales representative, becomes regional sales manager, with headquarters in Greensboro, N. C. These appointments, reflect a broadened marketing organization for Caprolan yarn.

Charles A. Church has been appointed sales promotion manager for the Firestone Synthetic Rubber & Latex Co., Akron, O. He has been with the company's advertising department since 1956.

William H. Jefferson becomes vice president, general sales manager, for General Latex & Chemical Corp., Cambridge, Mass. He previously was assistant to the president. His appointment is part of a reorganization of the corporation's sales staff, resulting from the addition of new products to the General Latex line. **H. G. Brousseau,** technical sales manager, compounds and dispersions; **R. V. Does,** technical sales manager, natural and synthetic latices; and **J. B. Blomstrom,** technical sales manager, urethane foams, have been appointed to help promote these products in the rubber and plastics fields.

Donald T. Smith has been named technical sales representative, New England region, for Union Carbide Plastics Co., division of Union Carbide Corp., New York, N. Y. From the Boston office he will handle sales of Bakelite brand molding and extrusion materials which include polyethylene, phenolic, styrene, and vinyl resins and compounds.

H. W. Ritchey, vice president of Thiokol Chemical Corp., recently named to head Thiokol's rocket operations, has announced a new headquarters soon to be located in the Utah area. In addition Dr. Ritchey announced several key staff appointments. **E. F. Nauman,** at present general manager of Thiokol's Longhorn division, becomes general manager, Utah production division. **Ray McElvogue**, now production plant manager, Longhorn division, will succeed Nauman as general manager. **Bryce Wilhite,** assistant general manager, Utah division, and **H. Q. Holley,** technical director Longhorn division, will transfer to Dr. Ritchey's staff; while **John Higginson** continues as general manager of Thiokol's research and development facilities at Brigham City, Utah. Wilhite will assume many of the duties which Dr. Ritchey handled as technical director. **John Womble,** director of the technical liaison office, Huntsville, Ala., will move headquarters to Utah.

Carl Mullen, vice president, research and development, Gates Rubber Co., Denver, Colo., has been elected chairman of the technical committee of the Industrial Rubber Products Division of The Rubber Manufacturers Association, Inc., New York, N. Y. In his new capacity, Mullen will direct an advisory group which reviews and recommends specifications for industrial rubber products used in industry, government, and private business.

W. H. Jefferson R. O. Newton

Russell O. Newton has joined Erie Foundry Co., Erie, Pa., as sales manager. He was formerly New England sales manager for industrial products for Brown & Sharpe Mfg. Co. Erie Foundry manufactures hydraulic presses for metalworking and rubber, ceramic, and plastic molding.

Edwin A. Meyer has been appointed control manager of E. I. du Pont de Nemours & Co.'s elastomer chemicals department, Wilmington, Del. **W. Newlin Keen** suceeds him as assistant control manager. Meyer, with Du Pont since 1948, will fill the position previously held by **A. Lynam Satterthwaite** who retired recently. Keen formerly was supervising project manager during construction of the elastomer laboratory for Du Pont Co. (United Kingdom) Ltd., Hemel Hempstead, England. Since his return last May he has been superintendent at the elastomer laboratory.

Max F. Moyer has retired from the sales department of The Goodyear Tire & Rubber Co., Akron, O. He joined Goodyear in 1926, served in several managerships, and since 1958 held special assignments in the auto tire sales department.

Joseph L. Montague has been named development engineer, and **Dorian Doptoglon** a research chemist to the technical staff of Baker Castor Oil Co., Bayonne, N. J. Montague previously worked for the Naugatuck Chemical Division, United States Rubber Co., and for the inorganic chemicals division, Monsanto Chemical Co. Doptoglon has had diversified experience as a research chemist in urethane prepolymers, general organic intermediates, and textiles.

Henry E. Haxo becomes senior research scientist at the research center of United States Rubber Co., Wayne, N. J. A member of the elastomer research department, Dr. Haxo is engaged in research on oil-resistant rubber and the use of non-black fillers in rubber reinforcement. Dr. Haxo has been with the company since 1941 except for his military service (1942-1946).

News about People

G. D. Scott, Jr. Wm. T. Hall

William T. Hall has been named vice president in charge of sales, and **Gherald D. Scott, Jr.**, secretary-treasurer for the C. P. Hall Co., Akron, O. Hall was formerly sales manager. Scott has been assistant treasurer since 1957.

George E. Shepard becomes manager in charge of the newly established New England sales district for General Electric Co.'s silicone products department. With headquarters at 145 N. Beacon St., Boston, Mass., he will be responsible for the area including Massachusetts, Rhode Island, Maine, New Hampshire, Vermont, Connecticut, and upstate New York.

Lester F. Borchardt has been named managing director of General Mills' central research laboratories, Minneapolis, Minn. Formerly director of physical research at the laboratories, he will assume his new position full-time in June, after having attended an advanced course in management training. Until then, **W. B. Reynolds,** vice president in charge of research, will serve as acting managing director.

George L. Bruggemeier is now chief engineer for The Firestone Tire & Rubber Co., Akron, O. The former assistant chief engineer succeeds **W. K Adkins** who retired on January 1. **S. T. Wepsic** and **D. E. Engle** have been named assistant chief engineers. Wepsic has been associated with the company's synthetic rubber, petrochemical, and plastics operation. Engle recently served as plant engineer at Firestone's Memphis, Tenn., plant.

W. K. Adkins G. Bruggemeier

Charles R. Spencer has been appointed field sales manager of the industrial division of The Gates Rubber Co., Denver, Colo. Recently manager of distributor sales, Spencer will now be in charge of the more than 200 field representatives all over this country.

Richard K. Lasko has been appointed eastern regional sales manager, and **Robert L. LaBelle** southeastern regional sales manager for the coated fabrics and Koylon seating department of United States Rubber Co., New York, N. Y. Lasko will headquarter at Woonsocket, R. I., at the eastern manufacturing plant for Koylon foam cushioning. He formerly was sales manager of products made at the company's Stoughton, Wis., plant. LaBelle will operate from the Midwest manufacturing plant for Koylon foam cushioning and Naugahyde upholstery at Mishawaka, Ind. He was salesman for these products in Chicago, Ill.

Leland G. Cole has been appointed vice president, research, for Beckman Instruments, Inc., Fullerton, Calif. Dr. Cole will coordinate research and development programs conducted by the company's several operating divisions and assist in the formulation and presentation of special government research and development proposals.

Van L. Wanselow is now Milwaukee manager for the B. F. Goodrich Tire Co., succeeding **John F. Rend,** who has retired. Wanselow was equipment sales representative for the company in Chicago, Ill.

David B. Pall, president of Pall Corp., Glen Cove, N. Y., announced four new major engineering posts to be filled by the following men: **Charles H. Hacker,** chief engineer industrial filters; **Martin Kurz,** manager of porous metals; **Stanley Sakol,** assistant sales manager; and **Morris Sankey,** director of quality control.

John P. Swaggart has been elected vice president of The Bullard Clark Co., Danielson, Conn. He will continue as technical director of the Jacobs Rubber division of the company in addition to assuming his new responsibilities.

Howard C. Shepard and **Augustine R. Marusi** have been elected directors of the Borden Co., New York, N. Y. Shepard is former board chairman of the First National City Bank of New York; while Marusi is president of Borden Chemical Co., a division of the Borden Co. He was elected vice president of the Borden Co. in 1955.

C. R. Spencer T. W. Brasfield

T. W. Brasfield has been appointed director of marketing, Velsicol Chemical Corp., Chicago, Ill. He will be responsible for all Velsicol's United States marketing activities, including resins, solvents, and inorganic chemicals.

David X. Klein, technical director of Heyden Chemical Division, Heyden Newport Chemical Corp., New York, N. Y., has been named divisional vice president. He has been responsible for the division's expansion and new products program.

John E. Capizzano, vice president, and **Harold V. Pearson,** secretary, were honored for 25 years of service with the American Mineral Spirits Co., Chicago, Ill. They received awards and gifts at a dinner given in New York, N. Y.

Robert N. Holland has been appointed industrial relations assistant for The B. F. Goodrich Co.'s tire plant at Akron, O. He has held the position of union relations representative for the company. He joined B. F. Goodrich in 1953 as an industrial engineer in the tire division.

August Napravnik has been named vice president in charge of production for Catalin Corp. of America, New York, N. Y., according to Harry Krehbiel, president. Napravnik, who recently held the position of production manager, will now be responsible for all phases of production and manufacturing at all Catalin plants.

J. P. Swaggart A. Napravnik

News about People

M. P. Binns

G. D. Grogan

F. O. Haas has been elected president of Rohm & Haas Co., Philadelphia, Pa., and chairman of the executive committee of the board, succeeding the late **Otto Haas.** F. O. Haas has held the positions of executive vice president, member of the executive committee, and director of the company. **Ralph Connor** is now chairman of the board and will continue as a member of the executive committee and as vice president, research. **John C. Haas** replaces **F. O. Haas** as vice chairman of the board. The former is also a vice president of the company and a member of the executive committee.

R. Emmet Kelly, medical director, Monsanto Chemical Co., St. Louis, Mo., has been appointed chairman of the medical advisory committee of the Manufacturing Chemists' Association, Inc., Washington, D. C. **T. W. Nale,** medical director of Union Carbide Corp., New York, N. Y., is vice chairman. The committee prepares information on the toxicology of industrial chemicals, medical treatment for exposure, and essential first-aid measures, which it publishes in the Association's chemical safety data sheet series.

Roy G. Volkman becomes general superintendent of the Lactron thread and Royalene filament division of United States Rubber Co.'s plant at Providence, R. I. He has been with the company since 1936.

Robert Fenwick becomes sales manager, aviation division, of Dunlop Canada, Ltd., Toronto, Ont., Canada. Previously he was responsible for the development of rubber tank linings for mining and industry.

Harry H. Weinstock, Jr., will fill the newly created position of coordinator, polyamide research and development, for Allied Chemical Co.'s National Aniline Division, New York, N. Y. Dr. Weinstock will be responsible for coordinating all research and development activities related to the company's Nylon 6 product, Caprolan. He previously held the position of assistant manager of central research.

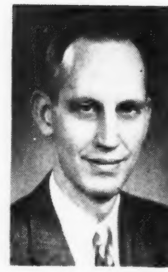
George D. Grogan has been named general sales manager of the industrial chemicals division, Pennsalt Chemicals Corp., Philadelphia, Pa. Formerly manager of chemical sales, he succeeds **George R. Lawson,** recently appointed general manager of the chemical specialties division. **W. G. Kayser, Jr.,** fills the newly created post of sales manager of organic chemicals for the industrial chemical division. He previously was product manager. **Arthur F. Bixby** is now manager of sales for the same division. Previously manager of marketing research. Bixby will supervise the administrative work of the division's sales activities. **Melbourne P. Binns** has been named product manager for the division. He was in the development department at Pittsburgh.

F. A. Hessel has been appointed manager of commercial research, **W. W. Williams** manager of foreign liaison, and **Miss J. M. Moran** senior development specialist for the newly created corporate development department of General Aniline & Film Corp., New York, N. Y. Dr. Hessel previously held the position of commercial research manager of the commercial development department of the company's dyestuff and chemical division. Dr. Williams was formerly foreign technical representative for the dyestuff and chemical division. Miss Moran was supervisor, technical service, in the dyestuff and chemical division's commercial development department.

George R. Throop, Jr., has been named Midwest sales manager, with headquarters at Columbus, O., and **W. J. Bolin,** southern sales manager at St. Louis, Mo., for American Zinc Sales Co., St. Louis. Throop, formerly Chicago district manager, will now be in charge of the company's sales activities in Ohio, Illinois, Indiana, Michigan, western New York, western Pennsylvania, and Wisconsin. Bolin will be in charge of sales of zinc pigments in the south and southwest regions and will assume new responsibilities for all products manufactured by American Zinc. He was previously central district manager.

J. R. Englund has been advanced to the managership of the battery parts sales division of American Hard Rubber Co., division of Amerace Corp., Butler, N. J. He succeeds **Howard B. Klippel,** who is retiring after 32 years with the organization.

J. F. Powers, Jr., is now vice president and sales manager of Chiksan Co., Brea, Calif., a subsidiary of Food Machinery & Chemical Corp. He formerly was eastern regional sales manager, with headquarters at Newark, N. J.



W. G. Kayser, Jr.

A. F. Bixby

F. D. Carney has been named manager of operations, research and development, B. F. Goodrich Canada, Ltd., Kitchener, Ont. His new responsibilities include overall analyses in physical marketing and distribution problems and the application of scientific methods for company planning, procedure, and control. **Duncan Douglass** succeeds him as manager of sales services and will be responsible for branch operating and customer service.

Frank J. Lewis, of the chemicals division, Canadian Industries, Ltd., Montreal, P.Q., Canada, has been appointed a special representative to service the Canadian oil and rubber industries. He will specialize in oil additives and rubber chemicals. Lewis has been with the company since 1940.

Benedict Letizia has been assigned as a technical sales representative to the north central region for the Cincinnati, O., office of Union Carbide Plastics Co., a division of Union Carbide Corp. He will be handling the sales of Bakelite brand bonding and laminating resins.

Monroe Mirsky becomes chief rubber chemist for the plastics and rubber division, Wyatt Industries, Inc., Houston, Tex. He will head a research staff for expansion of product research development and quality control at the recently purchased laboratory in Houston.

Charles H. Sturgeon, general traffic manager of The B. F. Goodrich Co., Akron, O., has become the first American to be elected an associate of the Institute of Transport of Great Britain. He is also a member of the American Society of Traffic & Transportation. Becoming a member of the American group requires successful completion of five examinations and a thesis.

Robert W. Cairns, since 1955 director of research for Hercules Powder Co., Wilmington, Del., has been elected a member of the board of directors.

News about People

Pach Bros., N.Y. © Vincent James, N.Y.

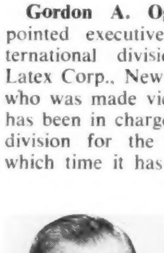
E. J. Higgins P. C. Rowe

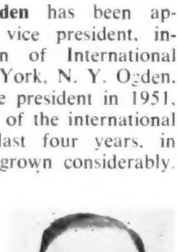
Edward J. Higgins has been appointed general manager of the international division of United States Rubber Co., New York, N. Y. Formerly assistant general manager, Higgins will now direct all the company's manufacturing and marketing activities outside the United States and Canada. He succeeds the late **Ludwig C. Boos.**

Arnold C. Matthies has returned from an overseas assignment with Esso Export Corp., New York, N. Y., to resume his position as products manager, chemicals, for Enjay Co., New York. **Harry W. Peterson, Jr.,** who has been serving as products manager, chemicals, in Matthies's absence, becomes manager of Enjay's Mid-Atlantic district. **T. Curry Jones,** former manager of that district, becomes assistant products manager, paramins.

Harry E. Chesebrough, vice president of Chrysler Corp. and general manager of Plymouth-De Soto-Valiant Division, is now president of the Society of Automotive Engineers, Inc. Chesebrough, who has spent 25 years in the automobile industry and 18 years with SAE, recently helped reorganize the Society in order to meet the increased rate of technical progress.

Gordon A. Ogden has been appointed executive vice president, international division of International Latex Corp., New York, N. Y. Ogden, who was made vice president in 1951, has been in charge of the international division for the last four years, in which time it has grown considerably.





G. A. Ogden H. B. Seligman

Perce C. Rowe has been elected a group executive vice president of United States Rubber Co., New York, N. Y. He will be responsible for all activities of the tire division, which accounts for approximately one half of the company's business. He was formerly president and a director of Curtis Cos., Inc., Clinton, Iowa, and president of The Flintkote Co., New York, N. Y.

Richard Finn, Harvey M. Mauel, Robert F. Deacon, and **John W. Stout** have been assigned as district engineers to four regional sales offices of The Torrington Co., Torrington, Conn., manufacturer of anti-friction bearings. Finn joins the office at Tulsa, Okla.; Mauel has been assigned to the Eastchester, N. Y., office, Deacon goes to the Pittsburgh, Pa. office; while Stout has been sent to Philadelphia, Pa.

T. F. Cooke has been appointed director of the chemical research department, and **Robert S. Long** commercial development manager for the organic chemicals division of American Cyanamid Co., New York, N. Y. Dr. Cooke has served the company in several research and technical service managerial positions. Dr. Long recently was director of product research for Cyanamid's organic chemicals division laboratories, Bound Brook, N. J.

L. R. Clarke is now New England representative for rubber chemicals with Beacon Chemical Industries, Inc., Cambridge, Mass. He has held a number of important positions with other companies, principally Haartz-Mason, Inc., and in 1943 was chairman of the Boston Rubber Group.

Earl Huffman is now district sales manager of the Kansas City, Mo., region for Dayton Industrial Products Co., a division of the Dayton Rubber Co. He will handle sales of the division's line of automotive V-belts, radiator and heater hose in the western Missouri, Kansas, and northern Arkansas region.

Harold B. Seligman, Jerome Harrison, and **Stanley D. Shaw** have received new assignments with the organic chemicals division of Witco Chemical Co., Inc., New York, N. Y. Seligman, formerly financial and administrative vice president, is now vice president and general manager of the division and will remain in New York. Harrison, who has been vice president in charge of midwestern sales for this division, is now vice president and director of marketing. He moves from Chicago to New York. Shaw, previously assistant midwestern sales manager, is now midwestern sales manager, with his office in Chicago.

F. J. Raba J. A. Dixon

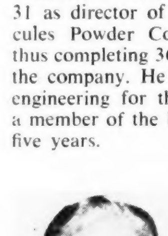
Frank J. Raba has been named sales representative for the rubber chemicals department, American Cyanamid Co., Bound Brook, N. J. Prior to this he was with the Triangle Conduit & Cable Co., New Brunswick, N. J.

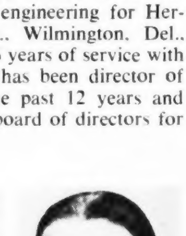
J. A. Dixon, director and general marketing manager of Courtaulds (Canada), Ltd., has been elected chairman of the promotion advisory committee of Tyrex, Inc., New York, N. Y., succeeding **George I. Rounds,** vice president in charge of marketing, Industrial Rayon Corp., Cleveland, O.

Charles H. Bair is now manager of retread plants for the tire division of The Dayton Rubber Co., Dayton, O. He will be responsible for the design, installation, and general operation of the tire division's retread plants in this country. The position was created because of the growth in the number of Dayton tire sales districts. Bair formerly was responsible for central U. S. retread operations for a major tire company.

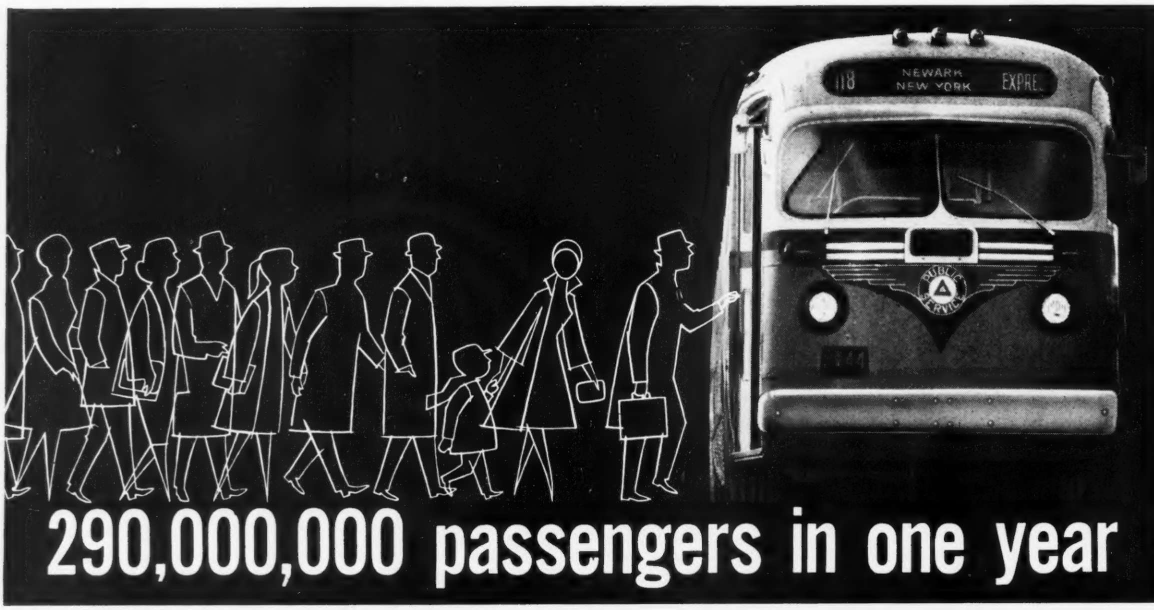
William J. Fritton has been elected executive vice president of U. S. Rubber Reclaiming Co., Inc., Buffalo, N. Y. He joined the company in 1956 and was elected a vice president in 1957 and a director in 1958.

Ernest S. Wilson retired December 31 as director of engineering for Hercules Powder Co., Wilmington, Del., thus completing 36 years of service with the company. He has been director of engineering for the past 12 years and a member of the board of directors for five years.





S. D. Shaw J. Harrison



Public Service Coordinated Transport, owner and operator of 2511 buses in New Jersey, with established routes into the cities of New York, Philadelphia and Wilmington, carried 290,000,000 passengers over 90,000,000 miles in 1958 alone. Impressive as these statistics sound, they made little or no impression on the heavy duty coated fabric upholstery used by the company. So sturdy is this material that much of Public Service's original purchase, made in 1947, is still standing up under everyday use.

In making Koroseal, the supported vinyl upholstery material producing these amazing wear results, B. F. Goodrich looks to Wellington Sears for the strong fabric backing it requires . . . one of the many Wellington Sears fabrics engineered for specific jobs of all kinds.

For cotton or synthetic industrial textiles, more and more companies are turning to Wellington Sears—and taking advantage of our more than a century of experience in providing fabrics to industry. For help in your own fabric applications, write for technical assistance and a free illustrated booklet, "Fabrics Plus," Dept. H-2.

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News about People

J. L. Ernst has been named district manager, Akron, O., for Enjay Co., Inc. He has worked with an affiliated company and played an important part in the successful application of butyl rubber for tires.

Harry D. Smith has been named manager of Goodyear Tire & Rubber Co.'s international synthetic rubber projects. He succeeds the late George R. Lyon, with whom he had worked on synthetic rubber projects in England and Japan. Smith most recently held the position of project manager for synthetic operations.

C. J. Schmidt has been named vice president of Midland-Ross Corp., Cleveland, O. He was made executive vice president of the J. O. Ross Engineering Division in 1956. He has been with the Ross organization since 1930.

Hyman Silver has been appointed chief chemist, Ace Rubber Products, Inc., Akron, O. He was formerly with the laboratory of Midwest Rubber Reclaiming Co., Barberton, O. Ace Rubber Products manufactures rubber mats and matting for automotive, household, and industrial use.

Putnam B. McDowell has been elected vice president, administration, a newly created position, for Pittsburgh Coke & Chemical Co., Pittsburgh, Pa. Formerly assistant to the president, McDowell will now be responsible for administration of general corporate policy and for coordination of line and staff activities.

Robert Strain has been named industry manager for polymer and surfactant chemicals by Armour Industrial Chemical Co., Chicago, Ill. He will be concerned with the commercial development of industrial emulsifiers and specialized processing aids for rubber and other high polymers.

John A. Parsons has been elected president, and **Elmer G. Smith** executive vice president of American Plastics Corp., a subsidiary of Heyden Newport Chemical Corp., New York, N. Y. Parsons, formerly executive vice president, has been in the plastics industry for more than 40 years. Smith, former sales manager, had been made vice president of the subsidiary earlier this year.

Charles R. Spencer has been named field sales manager of the Gates Rubber Co., Denver, Colo. Previously manager of distribution sales, Spencer will now be in charge of more than 200 field representatives in 20 districts in this country. He reports to **Mark T. Gilkinson,** manager of industrial sales.

Lawrence L. Smith is now general manager, manufacturing, of Amoco Chemicals Corp., Chicago, Ill. In this newly created position Smith will be in charge of all manufacturing operations, of engineering and construction of manufacturing facilities, and of supply and transportation. He will continue as a director of the corporation. This past year he was on special assignment in connection with the formation of Amoco Fina S. A. by Amoco Chemicals Corp. and Petrofina S. A., Belgium.

Alex B. Bourquard has been advanced to vice president-controller of The Ohio Rubber Co., Willoughby, O., a division of The Eagle-Picher Co. He has served as division controller for the company since 1958.

Mort Leggett is now manager of nationwide publications for The Goodyear Tire & Rubber Co., Akron, O. He had been editor of the company's *Wingfoot Clan*, a weekly employe newspaper.

Rush F. McLeary has been elected to the newly created post of vice president for research and development with Jefferson Chemical Co., Houston, Tex. Dr. McLeary will be responsible for expanding activities in customer technical service and product application as well as research leading to new products.

L. Paul Dougherty and **Jack Doyle** have joined the organic chemical sales staff of Emery Industries, Inc., Cincinnati, O. Dougherty will cover the New England territory; while Doyle will handle an area that includes West Virginia, southeastern Ohio, western Pennsylvania, and western New York State.

Jean F. Malone has been named sales development manager of plastic materials for B. F. Goodrich Chemical Co., Cleveland, O. In his new capacity he will direct sales and technical activities connected with new plastic materials.

Joseph A. Martino, since 1947 president of National Lead Co., New York, N. Y., has been elected a director of The Goodyear Tire & Rubber Co., Akron, O. Martino has been with National Lead since 1916.

Harold S. Reed has been named head of the new industrial relations department of McCreary Tire & Rubber Co., Indiana, Pa. He had been development manager and head of the technical department since 1949. **Lawrence M. Longworth**, since 1958 chief chemist of the company, succeeds Reed as development manager.

A. M. Eggeman is now director of purchases for Witco Chemical Co., Inc., New York, N. Y. He replaces **M. D. MacBurney,** recently appointed general manager of the Pioneer Products division. Eggeman was formerly assistant director of purchases.

Robert E. Rehm has been appointed manager of The General Tire & Rubber Co.'s new tire manufacturing plant at Mayfield, Ky., which will be completed next fall. Rehm has been production manager at the company's Akron tire plant.

James R. Cooper becomes general sales manager of the Vulcan Rubber Products Division, Reeves Bros., Inc., New York, N. Y. **Walter A. McEvilly** replaces him as product manager for Vulcan offset and newspaper blankets. McEvilly previously was a sales representative for Vulcan offset blankets in Chicago, Ill.

Stephen E. Petrasek is now manager, race tire design, for The Firestone Tire & Rubber Co., Akron, O. He has worked on all phases of tire development. Most recently he was assigned as a development engineer, race tire development.

C. Ritchie Timm has been appointed director of engineering, Dominion Rubber Co., Ltd., Montreal, P.Q., Canada. He succeeds **Robert Ford,** who retired December 31. Timm's former position was assistant to the director of engineering.

Obituaries

Rees F. Tener

Rees F. Tener, since July, 1930, assistant chief of the testing and specifications section, National Bureau of Standards, Washington, D. C., died suddenly on Christmas Day.

He was born May 14, 1896, at Sinking Springs, O. He received his A.B. degree in chemistry from Marietta College, 1920, and an M.S. degree from George Washington University, 1926. From 1916 to 1919 he served in the United States Army. He taught physics and chemistry at high schools in Barberton, O., from 1922 to 1924, then joined the NBS rubber section.

Mr. Tener received the Department of Commerce Meritorious Service Award in 1953 for his outstanding work in the development of federal specifications and test methods for rubber products, floor coverings, and other organic

(Continued on page 730)

NEWS from ABROAD

Research in Malaya

Many people in Malaya seem to think the solution to the problems with which synthetic rubber confronts the natural product is one mainly of drumming up trade. Only recently a member in the Senate suggested that the rubber industry should adopt methods similar to those used by promoters of soap.

But there is a growing realization of the importance of fundamental research. In a recent editorial the *Straits Times* points out that a greater threat than the increase in synthetic production is the continuing improvement in its quality and especially the emergence of stereospecific polymers. The editorial recalls that it is six years since the Rubber Research Institute issued its special warning on the need of improving the quality of natural rubber "beyond recognition," and stresses that the respite afforded by present gratifying price levels should be utilized for the fundamental research that will keep natural rubber qualitatively competitive.

From this point of view the Annual Report of the RRI for 1957, just to hand, is particularly interesting. It reveals that the original program of research was reviewed in line with the recommendations of the Blackman Committee and the members of the Rubber Producers' Council. The Chemical Division, we note, made the following advances during the year:

(1). Biochemical studies of the non-rubber constituents of latex were applied to improve quality, and further improvements are indicated.

(2). The microbiological study of latex before, during, and after its flow from the tree led to improved quality of latex and the discovery of a promising new method of yield stimulation. Further studies here suggest that in the vicinity of the tapping cut, at least, latex is modified as a result of tapping (wound response) or bacterial infection, or both.

(3). Means were discovered to obtain highly increased chemical activity of the rubber hydrocarbon in latex fresh from the tree and to utilize such activity in the preparation of valuable new modified rubbers by graft polymerization.

(4). Good progress was made in developing new, low-ammonia systems for preserved latex concentrate.

The tremendous amount of work involved in breeding high-yielding strains of *Hevea* is evident from the report of the Botanical Division. No fewer than 8,890 hand-pollinations were carried out in 1959, representing 11 different crosses and resulting in 995 seedlings. In connection with investigations on stock/scion effects in *Hevea* buddings, and disease resistance, a large-scale field trial was undertaken to study the effects of nine Dothidella-resistant clones (that is, clones resistant to the dangerous South American leaf disease) top-budded on three high-yielding Malayan clones.

Very interesting is the new work on the propagation of *Hevea* from leaves and young shoots to discover whether large-scale propagation of clones on their own roots and of clonal root-stocks is possible. At present, selected clones are budgrafted on to seedling stock; studies suggest that the influence of the stock may be responsible for disappointing results from second-generation buddings that are sometimes obtained. The possibility of obtaining optimum performance from the buddings is offered by the production of clonal root-stocks with which suitable buddings could be matched. An even more intriguing prospect is the possibility that a cutting from a high-yielding clone may give optimum yields when grown on its own roots, for then the clone could be propagated directly, without the need of budgrafting.

A report on this subject in the November, 1959, issue of the *Planters' Bulletin* states that so far cuttings from two clones have been satisfactorily rooted and that rooted cuttings and clonal root-stocks of a few clones can be provided for research purposes.

Malaya Reevaluates USSR Stockpile Sales

The rumors about recent Russian sales of natural rubber have now been corrected, and the matter put in proper perspective by a London report of a Russian announcement. From this it appears that Russia simply decided to sell 30,000 to 50,000 tons of rubber from stockpile to her own consumers during the first quarter of 1960. Furthermore, she is on a buyers' strike: prevailing prices are too high, and until they drop to a reasonable level—say one Straits dollar a pound—she will not be interested in buying new rubber.

A source in the Federation Government, quoted by the *Straits Times*, sees the situation as follows: Russia buys rubber either for her own use or for reexport. As long as reexports do not go to the Free World markets, no effects will be felt, and local traders are not unduly worried. But the Singapore rubber market is very sensitive, and it reacted to the report that Russia would stop buying until the price was $1.00 a pound, a report difficult to reconcile with the fact that Russia was in the market in October and November when the price was about $1.30 a pound. The Russian stockpile release to her own consumers, or East European countries, brings up no new fact since it is known that Russia used to buy rubber on behalf of satellite countries, and the present release could represent a delayed transfer of a purchase.

Meanwhile, official figures show that Russia and China between them took 20% of the record November shipments from Malaya, amounting to 109,469 tons.

A list of average Singapore rubber prices since 1950, recently published, reveals the 1959 boom as relatively modest. The average for that year, at 101.35 cents, must stand comparison with that for 1950, at 108.18 cents; for 1955 at 144.16 cents, and for that memorable year 1951—at 169.55 cents. The 1959 average, however, is undoubtedly a comforting figure for producers when put beside the 67.44 cents and 67.30 cents of 1953 and 1954, respectively.

Conferences in Malaya

In the coming September three important conferences will be held in Malaya. Shippers and packers will meet in Singapore in the first week of the month to discuss standards and quality, including packing. The seven-day conference of the International Rubber Study Group will take place in Kuala Lumpur during the week of September 12, when the topics will be: natural rubber production increase; the position of natural rubber latex in the face of increased competition from synthetic latices; new uses for natural rubber; and marketing problems.

Finally will come a conference on natural rubber research, scheduled for September 26-October 1, also in Kuala Lumpur. Sponsored by the Rubber Research Institute of Malaya and supported by the Federation Government and the Rubber Producers' Council, the conference will be divided into two sections, to be held concurrently; one section, concerned with production, will take up ground covers, weed control, ecology and environment, breed-

U.S. Rubber fenders of Enjay Butyl taking a 2000 horsepower push without damage to ship or dock! Installed on #7 Oil Dock, Nueces County Navigation District, Corpus Christi, Texas.

ing and selection, yield stimulation, pests and diseases. The other will deal with research on the properties and use of natural rubber latex, the biochemistry and microbiology of latex, and factory practice for latex.

Kuala Lumpur Wants Its Own Rubber Market

That Kuala Lumpur should have its own rubber market is a view finding increasing support in Federation producing and trading circles, H. Kissin, deputy chairman and managing director of Lewis & Peat, London merchant and broker, noted on a recent visit to Malaya. He foresees big developments in marketing facilities for rubber and other commodities in Malaya as the wish grows among rubber producers and dealers to be able to do business directly with each other through a Kuala Lumpur market instead of through Singapore, as at present. This feeling, Mr. Kissin found, has lately been increased by the record shipments and production of rubber. His talks have convinced him that the government would have to promote such a market, and he advised the Singapore Chamber of Commerce Rubber Association and Rubber Trade Association, in Singapore, to assist such a project. Then the Singapore and Kuala Lumpur markets could complement each other, to the benefit of the whole rubber trade in southeast Asia.

In Kuala Lumpur, the consensus of opinion on these remarks seemed to be that while a market in that town is inevitable, the development of such a market would be slow. Most rubber men undoubtedly inclined to the view expressed by some, that as a first step a clearing house and a branch of the Singapore market should be started and that a system of close cooperation with Singapore would be best.

USSR Synthetic Rubber Production Increasing

Russian production of synthetic rubber has shown a tremendous increase over the modest beginnings of a little more than 20 years ago. In the prewar period of 1934/35, production was at an annual rate of 26,000 tons. In 1958, production amounted to 460,000 tons.[1] The current seven-year plan covering the 1959-1965 period calls for a change in basic types of synthetic from the sodium-butadiene type to other types, as well as an overall production increase of 360%. Improved quality is given as the reason for the shift in type emphasis.

As the following table indicates, increased importance is expected in the use of butyl, chloroprene, and isoprene in addition to the SBR types. Production of the sodium rubbers will be drastically cut.

Synthetic Rubber Type	% of 1959 Output	% Planned for 1960
Styrene-butadiene, and butadiene-methyl-styrene	38.3	43.6
Sodium-butadien	50.7	8.5
Nitrile	3.8	2.9
Butyl	0.4	5.3
Chloroprene	6.6	12.6
Isoprene	—	25.0
Other types	0.2	2.1

Part of the increased production can be anticipated from an announced contract awarded to John Dalgleish & Sons, Ltd., Glasgow, Scotland, for £500,000 which is reported to be for establishing a synthetic rubber plant in Siberia.

[1] *Plaste u. Kautschuk*, Nov., 1959, p. 556.

Black-SBR Masterbatch Development Explained

Carbon black masterbatch developments were explained and discussed in an article appearing in *Rubber and Plastics Age*,[1] written by Clayton F. Ruebensaal, Texas-U.S. Chemical Co., Port Neches, Tex. Title of the article was "The Development of Carbon Black-SBR Masterbatches." The paper discussed the revived interest in this product in the United States. It is not yet being manufactured in the United Kingdom or the rest of Europe.

In covering the historical background, Ruebensaal states that the black masterbatches received very good reception after their introduction in 1944. The years 1949 to 1957, however, saw the percentage of rubber used in black masterbatch fall from the high of 25% to the low of 7%. Reason for this decline was the fact that these early masterbatches required much additional work to achieve maximum dispersion and to obtain the best physicals.

In the last two years this situation has changed, and partly because of price advantage and a trend toward a desire on the part of consumers to let the supplier do some of the original mixing, the use of masterbatch has increased. The major factor in its revived use, however, is the advanced technology which allows better physical properties to be obtained with less work in the consumer's plant. Some of the general advantages claimed for masterbatch, according to the author, are time savings, power savings, inventory savings, savings on cleaning, and overseas freight savings.

Heading the list of technological improvements is the development of mechanically mixed masterbatches as opposed to merely dispersing in latex. Specific advantages claimed for mechanically mixed masterbatch include less non-rubber components, added power and time savings, improved physical properties, and greater versatility in loadings.

Present status of black masterbatch in the United States is described as growing fast. From an offering of only six types in 1955, today 71 different masterbatches are offered by seven companies. In fact, considerable confusion exists due to the number of variations which differ only slightly, to too many types which cannot be related to familiar polymer types, and to lack of standardization on nomenclature.

The future aim, as Mr. Ruebensaal sees it, should be for the producers to have as their objective the production of fewer variations of carbon black masterbatch, but with wider variations so that by blending and additions the required properties could be obtained. This would bring the word masterbatch back to its original meaning, i.e., "a batch or mix of base polymer containing a uniform predispersion of a reinforcing filler, pigment, or chemical additive, which may be subsequently easily blended with additional quantities of the same or other components or masterbatches to make a variety of compounds."

The author concludes that the growth of black masterbatch and the trend to premixed polymers should see a new era of valuable varients of current materials as well as some truly new rubbers designed for quality and a wider range of end-use outlets.

[1] Oct., 1959, p. 1044.

North British Rubber Opens Hose Factory

North British Rubber Co., a subsidiary of United States Rubber Co., has placed in operation in Edinburgh, Scotland, a modern hose factory that is the major, and final, phase of an $8.5-million expansion and modernization program begun in 1956.

One of the most modern industrial hose manufacturing units in Europe, this new unit is a one-story brick and steel structure with 84,000 square feet of manufacturing area. The equipment it houses is used to make a range of hose for the world's oil fields and high-pressure hose for the British market. Both general hose types are established products of this company.

The hose plant was erected on a seven-acre plot of the company's 22-acre factory site in Edinburgh. The plant has two 70-foot wide bays, each 600 feet long, which permit direct-flow construction of hose from the reception of raw materials at one end of the structure to shipment of finished

goods from the far end. Room is also available for the construction of a third bay, which would allow a 50% boost in production.

Among the varieties of hose being produced in the new plant are air, water suction, steam, spray, chemical, oxy-acetylene, brewers, sandblast, tar-spraying, and fire-fighting. Emphasis is being placed on braided hose, which combines toughness with light weight and flexibility.

Other projects of the expansion program included doubling the firm's tire production, modernization of its footwear production facilities in nearby Dumfries, and erection of a new central steam plant in Edinburgh.

Goodyear Plans Tire Plant in India

Plans for a $12-million tire and tube manufacturing project 20 miles south of New Delhi, India, were recently announced by the Goodyear Tire & Rubber Co. The new plant, the third new plant facility abroad to be announced by Goodyear within the past year, will be located on a 50-acre site on the Agra road which leads to the Taj Mahal.

The decision to locate the plant in India demonstrates support of the growing Indian economy by American industry—action specifically recommended by President Eisenhower during his recent visit there. Improved economic conditions and standards of living in India are being accompanied by increased vehicle registrations, said a Goodyear spokesman. The new Goodyear installation will help fulfill the need of tires these transportation advances are creating.

The new plant of the Goodyear Tire & Rubber Co. of India, Ltd., will employ approximately 900 workers, virtually all Indians, and is expected to be completed early in 1961. Goodyear has maintained a growing sales company in India since 1923, which has developed a volume that now makes necessary the establishment of the company's own production facility there.

The plant will be equipped with the most modern tire manufacturing machinery for the production of passenger, truck, and farm tires and tubes. A team of Goodyear engineers is in India, and construction is scheduled to begin immediately.

The new plant brings to 58 the number of Goodyear manufacturing locations.

Pelletized News

The new Malayan wage system introduced experimentally last June is likely to become permanent. Results for the first two months have been satisfactory. The plan calls for a basic guaranteed wage for plantation workers plus a bonus for extra latex brought in by tappers. Increased yields in some areas have already resulted since the introduction of the plan.

ENGLEBERT & CO., S.A., Liege, Belgium, will build a factory to manufacture bicycle tires in Belgian Congo, to meet the steadily increasing demand from that area. Local sources will largely provide needed supplies of rubber and textiles, it is understood.

A. G. Treadgold *(second from left)*, United Carbon's vice president, manufacturing, makes a friendly point to Mr. Price *(far left)*, a director of Standard Vacuum. C. Coleman *(far right)*, United's chairman, and an associate of Mr. Price *(second from right)* look on. Occasion was the official opening of Australian Carbon Pty. Ltd. plant

DENKI KAGAKU CO. and KANEGAFUCHI CHEMICAL CO., have been producing chloroprene rubbers on an experimental scale in Japan and are now discussing commercial production.

The Ministry of Commerce & Industry and the Federation Legal Department of Malaya are said to be studying carefully the issues arising from the fact that through an omission, the law on forward buying and selling of rubber provides a loophole enabling rubber traders to back out of contracts. The omission is, the word "purchase" is not defined. In the early part of 1959 a High Court Judge ruled that forward contracts were *not* covered under "purchase," whereby dealers are practically given leave to back out of deals which may turn out to be unfavorable to them at the time of delivery.

UNITED CARBON CO. and GODFREY L. CABOT, INC., recently announced completion of Australia's first carbon black production facilities. The new plant will have initial capacity of 30 million pounds and will be able to supply all of Australia's current oil-furnace black requirements. Previously, Australia imported approximately 16,000 tons of carbon black per year, mostly from Great Britain. Designed and built by Cabot Engineering Co., the plant is located at Altona, Victoria, about 11 miles from Melbourne. Facilities on the 37-acre site include control and technical service laboratories. The joint venture, which will operate as Australia Carbon Black Pty. Ltd., marks United Carbon's first major step toward international plant development. United is reported to be currently the largest United States exporter of carbon black.

The new synthetic rubber plant built by N. V. Chemische Industrie AKU-Goodrich (CIAGO), in Arnhem, Holland, was officially opened on September 24, 1959. The company, jointly formed by the Algemene Kunstzijde Unie (AKU), Arnhem, and The B. F. Goodrich Co., Akron, O., U.S.A., will produce special-type nitrile latices, butadiene-styrene latices, and high-styrene SBR, to supply the European market, and especially the countries of the Common Market. The materials are to be sold under the Hycar trade name, it is understood.

COMMUNIST CHINA produced 1,520,000 automobile tires in 1958, *Plaste und Kautschuk*[1] reports in an article describing developments in that country's chemical industry. A factory with output capacity of 8,000 tons of synthetic rubber is now under construction, it is further noted.

[1]Sept., 1959, p. 426.

(Continued on page 731)

MARKET REVIEWS

Natural Rubber

During the December 16-January 15 period New York was still facing a technical shortage of near certified rubber. Apart from that there appeared to be substantial speculative bull interests who based their expectations on a continued buoyant American economy and the optimistic forecasts for car production and rising rubber consumption in 1960. These estimates talk of expected sales of 127 million tires and a total consumption of new rubber of 1,650,000 or even 1,700,000 tons. At the present natural/synthetic rubber ratio this represents more than 550,000 or 565,000 tons of natural.

London, where the tight near positions were reported to be leveling out, had been willing to follow downward moves, but had been swayed by the firmer New York market.

Added to these undecided conditions were hints that Russia would dispose of or take into consumption some 45-50,000 tons of stockpile or surplus rubber. Some precautionary liquidation in the Far East followed, but the markets are awaiting official announcement from Moscow.

Singapore contracts with Russia were completed during the period under review, and the last of the sales to China, amounting to some 7,000 tons, has been covered.

The General Services Administration announced that December sales of crude natural rubber from the national stockpile totaled 6,930 long tons. These sales bring to 19,580 long tons the quantity of rubber sold by GSA since the authorized disposal started last October 16.

December sales, on the New York Commodity Exchange, amounted to 11,460 tons, compared with 18,940 tons for November contract. There were 22 trading days in December, and 21 during the December 16-January 15 period.

On the physical market, RSS #1, according to the Rubber Trade Association of New York, averaged 41.64¢ per pound for the December 16-January 15 period. Average December sellers' prices for representative grades were: RSS 3, 40.26¢; #3 Amber Blankets, 38.12¢; and Flat Bark, 35.30¢.

Synthetic Rubber

Consumption of new rubber in the United States during 1959 established the highest year on record, amounting to 1,628,013 long tons, compared with the previous all-time high of 1,529,699 long tons used in 1955 and exceeding the 1958 consumption of 1,364,404 long tons, according to the monthly report of The Rubber Manufacturers Association, Inc.

Consumption of all types of synthetic rubber amounting to 1,072,759 long tons in 1959 reached a new record high contrasted with the previous high of 925,879 long tons used in 1957 and the 879,912 long tons consumed in 1958. Of the total new rubber consumed in 1959, synthetic rubber amounted to 65.89%, exceeding the 1958 ratio of 64.49%.

Production of synthetic rubber for 1959 reached a new yearly high of 1,379,849 long tons, against a previous all-time high of 1,118,173 long tons produced in 1957, and surpassing the output of 1,054,625 long tons reached in the year 1958.

Synthetic rubber consumption in December came to 90,485 long tons, an increase of 7.87% over the November consumption of 83,883 long tons. Synthetic rubber during December accounted for 67.71% of total new rubber consumption, a new high level, as compared with the previous high of 66.78% reached in October, and passing the November ratio of 66.62%.

Consumption by type in December, compared with November usage, in long tons, increased for SBR, neoprene, butyl, and nitrile as follows: SBR, 75,130, against 69,217; neoprene, 7,005, against 6,684; butyl, 5,690, against 5,327; and nitrile, 2,660, against 2,655.

Total synthetic exports rose in December to 30,265 tons from 24,168 tons in November. Total synthetic exports for 1959 were 287,758 tons, compared with 193,917 tons for the year 1958.

Trends in SBR masterbatches showed the oil-black masterbatch production up to 21,438 from 21,395 tons in November. Total oil-black masterbatch production for 1959 was 202,922 long tons. Carbon black masterbatches in contrast dropped to 4,479 tons in December from 4,733 tons in November. Carbon black masterbatch production for 1959 was 55,179 long tons. The oil-extended rubber production in December showed a slight increase to 26,764 tons from 26,203 tons in November. Oil-extended rubber production for the year 1959 reached a total of 309,779 long tons.

Latex

During the December 16-January 15 period there was some improvement in interest for drum latex; buyers took advantage of downward fluctuations in the price level, and although the offtake was only moderate, it would appear to have taken from the market most of the current offerings.

At the time of writing it was difficult to obtain anything for shipment before March. With the approach of the winter season in the East, the possibility of some hardening of the differential should not be ruled out.

The bulk latex market was reported continuing quiet, but steady.

Malayan production of latex in November totaled 11,178 tons, against 11,428 tons in October.

Prices for ASTM centrifuged concentrated natural latex, in tank-car quantities, f.o.b., rail tank car, ran about 46.00¢ per pound solids. Syn-

REX CONTRACT

1960	Dec. 18	Dec. 24	Dec. 31	Jan. 8	Jan. 15
Jan.	41.15	41.50	41.40	41.25	40.45
Mar.	40.15	39.90	39.63	39.83	39.70
May	39.00	38.70	38.10	38.70	38.80
July	38.20	37.80	36.90	37.75	37.90
Sept.	37.45	37.20	36.80	37.10	37.50
Nov.	37.05	36.80	36.40	36.45	36.75
1961					
Jan.	36.65	36.40	36.00	36.10	36.35

NEW YORK OUTSIDE MARKET

	Dec. 18	Dec. 24	Dec. 31	Jan. 8	Jan. 15
RSS #1	41.75	42.00	41.75	41.25	41.00
#2	41.63	41.88	41.63	41.13	40.88
#3	41.50	41.75	41.50	41.00	40.75
Pale Crepe					
#1 Thick	47.00	47.25	47.00	46.50	46.75
Thin	47.00	47.25	47.00	46.50	47.00
#3 Amber Blankets	41.38	41.88	41.63	41.00	40.88
Thin Brown Crepe	40.88	41.38	41.13	40.50	40.25
Standard Bark Flat	37.50	37.75	37.50	36.75	36.50

thetic latices prices were 26.0 to 40.25¢ for SBR: 37 to 57¢ for neoprene: and 45 to 60¢ per pound for the nitrile types.

(All figures in long tons, dry weight)

Type of Latex	Production	Imports	Consumption	Month-End Stocks
Natural				
Oct.	0	6,747	6,153	12,220
Nov.	0	*	4,858	11,707
SBR				
Oct.	9,424	—	7,388	7,570
Nov.	8,144	—	6,427	8,279
Neoprene				
Oct.	1,020	0	969	1,464
Nov.	1,206	0	893	1,451
Nitrile				
Oct.	1,187	0	1,158	2,888
Nov.	1,104	0	981	2,975

* Not available yet for period covered.

Scrap Rubber

Quiet trading characterized the scrap rubber market during the last week of December. A principal reclaimer in the East did not take in any scrap this week: while others were taking only limited quantities. Most consumers were on curtailed operating schedules at the year-end in preparation for inventory-taking.

The scrap rubber market early in the new year was without any particular feature. Trading was pretty much of a routine affair at previously quoted levels. Some reclaimers that had shut off or had sharply curtailed their acceptance of scrap during inventory-taking. were again taking in material although in some cases on a limited basis. Scrap prices held at previous levels.

	Eastern Points	Akron, O.
	Per Net Ton	
Mixed auto tires	$7.00	$12.50
S.A.G. truck tires	nom.	17.00
Peeling, No. 1	nom.	26.00
2	nom.	22.00
3	nom.	19.00
Tire buffings	nom.	nom.
	(¢ per Lb.)	
Auto tubes, mixed	4.00	4.00
Black	5.75	5.75
Red	6.25	6.25
Butyl	5.50	5.50

Reclaimed Rubber

The reclaimed rubber market for the December 16-January 15 period was evidently a case of a dip down and a rise up. according to a reclaimer in the East. Several plants apparently closed down for a period during the Christmas holidays. which shutdown resulted in low shipments from December 16 to the year-end. Then with the start-up in January came a natural increase in orders for the two-week period in question. ending January 15. In fact, there was a reported 40% rise in the shipments in the first two weeks in January. compared with those for the last two weeks in December.

There is also some question whether the full impact of the alleged first quarter boom has really begun to make itself felt as of the time of writing.

Another reclaimer. in the Midwest, reported that business during the period under review continued rather slow owing to the holidays and the then-threatening resumption of the steel strike. Following the settlement of this strike. however. there was a pickup. and this reclaimer expected business to be very good for the next few months.

According to The Rubber Manufacturers Association. Inc.. report. November production of reclaimed rubber was 22.550 long tons; while consumption was 20,100 long tons.

RECLAIMED RUBBER PRICES

Whole tire. first line	$0.11
Third line	.1025
Inner tube. black	.17
Red	.21
Butyl	.15
Light carcass	.22
Mechanical, light-colored. medium gravity	.155
Black, medium gravity	.085

The above list includes those items or classes only that determine the price basis of all derivative reclaim grades. Every manufacturer produces a variety of special reclaims, in each general group separately featuring characteristic properties of quality, workability, and specific gravity, at special prices.

Industrial Fabrics

Industrial grey cotton goods quotations. constructions that were not advanced during the last week of December. were pegged higher during the first week of January. Higher quoted prices were named on sateens. which moved 1½¢ a yard upward. Wide drills rose ½¢ a yard. though some mills sources that already were up remained unchanged. Chafer fabrics were quoted 2¢ a pound more. As much as 2¢ represented the advances on broken twills. Wide sheetings were on the firm side. it was reported; so concession eliminations reflected their stronger position.

Despite the firmer quotations. orders were placed at the higher levels. usually for out-of-stock shipments. Resale yardage tended to contribute a feeling of unreality to the mills' advances. according to one source. for there had been available yardage that included a selection of numerous descriptions. Such resellers' supplies were apparently the result of inventory-taking factors. rather than evidence of surpluses needing liquidation.

Though mills were not pressed for cloth. more business was done than in recent weeks. Partly. the business came through from industrial goods users and jobbers who were aware that preferred mill makes and qualities would not continue available at the then lowest quoted levels. So a number called for yardage. and a number immediately added to the size of commitments when their finished product customers took note of the changing conditions in the market.

Industrial Fabrics

Drills*

59-inch, 1.85, 68x40	*yd.*	$0.40
2.25, 68x40		.34

Broken Twills*

54-inch, 1.14, 76x52	*yd.*	.52
58-inch, 1.06, 76x52		.585
60-inch, 1.02, 76x52		.5825

Osnaburgs*

40-inch, 2.11, 35x25	*yd.*	.2275
3.65, 35x25		.1525
59-inch, 2.35, 32x26		.30
62-inch, 2.23, 32x26		.31

Ducks

Numbered Duck†

List less 45%

Enameling Ducks*

	S. F.	D. F.
38-inch, 1.78 yd.	$0.3263	.3313
2.00 yd.	.275	.33
51.5-inch, 1.35 yd.	.4738	.4888
57-inch, 1.22 yd.	.4838	.50
61.5-inch, 1.09 yd.	.5413	.5538

Hose and Belting Ducks*

Basis	*lb.*	.67

Army Duck†

52-inch, 11.70 oz., 54x40 (8.10 oz./sq.yd.)	*yd.*	.5925

Sheeting*

40-inch, 3.15, 64x64	*yd.*	.2175
3.60, 56x56		.185
52-inch, 3.85, 48x48		.2375
57-inch, 3.47, 48x48		.25
60-inch, 2.10, 64x64		.375
2.40, 56x56		.33

Sateens*

53-inch, 1.12, 96x60	*yd.*	.645
1.32, 96x64		.575
57-inch, 1.04, 96x60		.615
58-inch, 1.02, 96x60		.7025
1.21, 96x64		.63

Chafer Fabrics*

14.40-oz./sq.yd. P.Y.	*lb.*	.73
11.65-oz./sq.yd. S.Y.		.64
10.80-oz./sq.yd. S.Y.		.67
8.9-oz./sq.yd. S.Y.		.71
40-inch, 2.56, 35x25		.25
60-inch, 1.71, 35x25		.435

* Net 10 days.
† 2% 10 days.

Rayon and Nylon

Tire sales were good during 1959; in fact. it was the best sales year since the record-breaking year of 1955. despite strikes in both the rubber and steel industries. As a consequence. tire yarn sales were up. both in rayon and in nylon.

There was no change in the original-equipment passenger-car tire market. with most cars still leaving the factory on rayon cord tires. Truck man-

(*Continued on page 729*)

Market Reviews

(*Continued from page 726*)

ufacturers, however, substantially increased their use of nylon cord tires as original equipment, according to one source. There was some increase in sales of nylon cord replacement tires, both truck and passenger car.

There were two reductions in prices of tire yarn during the year, one in August, another in December. In each case the initial cut was made by Du Pont, followed by other producers of nylon tire yarn, and then followed by rayon producers. The nylon price cuts were the latest in a continuing series that has reduced the cost of nylon from $1.65 per pound in 1950 to its present cost of 97¢ per pound. In 1950 about one out of every 10 tires on the road was made with nylon cord. Today more than one-third of all tires on the road are said to be made with nylon cord.

What could develop into a major trend in tires was observed during 1959 when Mohawk Tire & Rubber Co. announced that production of rayon cord passenger-car tires had been discontinued. One of the largest distributors of tires in the auto supply store field—Western Auto Stores—also announced elimination of rayon cord tires from its inventories. In both passenger and truck tires, Western Auto will now carry only nylon tire cord tires.

Other tire reinforcing materials—wire, Nylon 6, and "Dacron" polyester fiber—attracted some interest during 1959. Firestone revealed plans to begin construction of a plant to produce Nylon 6, and Allied Chemical announced plans to triple its annual production of Nylon 6, designated Golden Caprolan.

The December and annual 1959 data, including production, shipment, and stock data, on rayon and acetate filament yarn will be available in the next issue of RUBBER WORLD.

RAYON PRICES

Tire Fabrics

1100/490/2	$0.625/$0.78
1650/908/2	.685
2200/980/2	.655

Tire Yarns

High-Tenacity		
1100/ 490, 980	.57/	.66
1100/ 490	.57/	.66
1150/ 490, 980	.59/	.63
1165/ 480	.59/	.66
1230/ 490	.59/	.63
1650/ 720	.50/	.60
1650/ 980	.50/	.58
1875/ 980	.55/	.58
2200/ 960	.49/	.57
2200/ 980	.49/	.57
2200/1466	.49/	.64
4400/2934		.60
Super-High Tenacity		
1650/ 720	.50/	.60
1900/ 720		.58

NYLON PRICES

Tire Yarns

840/140	.97
1680/280	.97

Obituaries

(Continued from page 719)

and fibrous products. He wrote several papers on the aging of rubber and its properties at high and low temperatures.

He was also particularly active in the work of the American Society for Testing Materials and served as chairman of subcommittees of Committee D-11 on Rubber and Rubber-Like Materials and D-13 on Textile Materials. In addition, the deceased represented the National Bureau of Standards on various committees of the American Standards Association. He also was vice chairman of the arrangements committee for the International Rubber Conference, Washington, last November. He was also a member of the American Chemical Society, Washington Academy of Sciences, and Washington Rubber Group.

Funeral services were held December 30 at Sinking Springs.

He is survived by his wife.

Josiah M. Cook

Josiah M. Cook, divisional manager of industrial product sales, American Hard Rubber Co., Butler, N. J., died suddenly on January 6.

He began working for American Hard Rubber in New York in 1924. In 1943 he moved to Akron, O., as a field engineer. The deceased became district sales office manager at Akron in 1946 and the next year was appointed divisional manager of industrial product sales at New York.

Mr. Cook was born July 1, 1896. He attended high school and Goldey College in Wilmington, Del.

His wife survives.

Funeral services were held January 9 at Eberett Kelley Funeral Home, Wilmington, Del., followed by private burial.

Ralph C. Feigles

Ralph Clifton Feigles, works manager of Sprout, Waldron & Co., Inc., Muncy, Pa., died suddenly December 13.

Mr. Feigles joined Sprout-Waldron in 1928, after his graduation from Muncy High School. In 1938 he was appointed works manager and functioned as a member of the executive committee.

He served as a member of the West Branch Manufacturers' Association and the American Foundryman's Association. He was recently reelected president of the Muncy Borough Council. The deceased also belonged to the Masons and Loyal Order of Moose.

He was born August 31, 1909, in Muncy. Mr. Feigles is survived by his wife, two sons, and a daughter.

Interment took place at Muncy Cemetery after funeral services held December 17.

Willett S. Chinery

Willett S. Chinery, retired vice president of Industrial Rubber Goods Co., St. Joseph, Mich., died suddenly, December 25, at his home in St. Joseph.

His entire business career was spent in the rubber industry. His first position in 1913 was with the S. S. White Co. He later held posts with Standard Tire Co., Firestone Tire & Rubber Co., Kokomo Rubber Co., and Brown Rubber Co., and he was among the founders of Baldwin Rubber Co. The deceased came to Industrial Rubber in 1941, as chief chemist and remained with the company until his retirement in 1958.

Mr. Chinery was a life member of the American Chemical Society and an active member of its Rubber Division. He also belonged to the Society of Automotive Engineers, having served on several committees, and of several rubber groups including one term as chairman for the Chicago group.

He was born June 25, 1891, in Norwalk, Conn. He was educated at Rensselaer Polytechnic Institute and the University of Akron.

He is survived by his wife and one son.

Frank H. North

Frank H. North, sales representative for the Harchem Division, Wallace & Tiernan, Inc., Belleville, N. J., died November 21 at his home.

Mr. North began his career in 1934 with United States Rubber Co. He later worked for The Flintkote Co., International Plastics, and Marko Chemical Co. In 1946 he joined the Harchem Division (then the W. C. Hardesty Co.). With Harchem, he covered most of the midwestern and eastern states. Recently he confined his activities to the New York, New Jersey, and Philadelphia area.

He was born in April, 1912. He received his B.S. degree from the Newark College of Engineering in 1934.

The deceased leaves his wife, three sons, and one daughter.

Pelletized News

(*Continued from page 723*)

OHTSU RUBBER CO., in collaboration with Dai Nippon Spinning Co., has succeeded in making Vinylon tire cord. The Japanese rubber company, which is said to have developed a fully automatic cord-processing machine, is already making Vinylon tires and expects to market them before long, at a price understood to be 10% under that for similar rayon tires. To start with, only heavy-duty tires will be made with the new cord. A further report states that both Du Pont and Dunlop have applied to Dai Nippon Spinning Co. for samples.

STATISTICS
of the RUBBER INDUSTRY

U.S.A. Imports and Production of Natural and Synthetic Latices

(Long Tons, Dry Weight)

Year	Natural	SBR	Neoprene	N-Type	Total Synthetic	Total Natural & Synthetic
1958	67,591	65,706	10,679	11,560	87,945	243,481
1959						
Jan.	8,574	7,801	1,049	1,104	9,954	18,528
Feb.	5,746	7,578	998	1,161	9,737	15,483
Mar.	7,039	8,587	1,013	1,269	10,869	17,908
Apr.	6,342	6,730	1,301	911	8,942	15,284
May	6,007	6,583	1,146	1,156	8,885	14,892
June	7,445	6,730	1,223	1,196	9,149	16,594
July	5,469	6,871	956	1,279	9,106	14,575
Aug.	7,131	8,225	1,242	1,258	10,725	17,856
Sept.	6,947	8,201	956	1,364	10,521	17,468
Oct.	6,747	9,424	1,020	1,187	11,631	18,378
Nov.*	....	8,144	1,206	1,104	10,454	....

* Preliminary.
Source: Bureau of the Census, Industry Division, Chemicals Branch, United States Department of Commerce.

U.S.A. Consumption of Natural (Including Latex) and Synthetic Rubber (Long Tons)

Year	Natural	SBR Types	Butyl	Neoprene	N-Type	Total Natural and Synthetic
1958	484,492	879,912	53,432	69,694	26,590	1,514,120
1959						
Jan.	49,913	74,222	5,359	7,198	2,857	139,549
Feb.	47,345	72,558	5,256	6,885	2,694	134,738
Mar.	51,991	78,792	5,687	7,444	3,166	147,080
Apr.	41,483	64,547	4,758	7,493	2,941	121,222
May	38,777	60,870	3,978	6,914	2,853	113,392
June	47,786	76,065	5,484	7,083	3,063	139,481
July	47,545	78,995	6,043	6,277	2,419	141,279
Aug.	46,914	75,340	5,533	7,117	3,047	137,951
Sept.	49,252	79,835	6,579	7,326	3,119	146,111
Oct.	49,049	81,963	5,965	7,538	3,128	147,643
Nov.*	42,039	69,217	5,327	6,684	2,655	125,922

* Preliminary.
Source: Bureau of the Census, Industry Division, Chemicals Branch, United States Department of Commerce.

U.S.A. Stocks of Latex

(Long Tons, Dry Weight)

Year	Natural	SBR	Neoprene	N-Type	Total Synthetic	Total Natural & Synthetic
1958	8,900	7,672	1,663	2,519	11,754	20,654
1959						
Jan.	10,025	7,822	1,551	2,418	11,791	21,816
Feb.	10,482	7,753	1,488	2,535	11,776	22,258
Mar.	9,375	8,209	1,441	2,670	12,320	21,695
Apr.	8,599	7,859	1,458	2,379	11,696	20,295
May	9,718	7,917	1,417	2,398	11,732	21,450
June	11,063	7,314	1,601	2,432	11,347	22,410
July	10,752	6,983	1,528	2,761	11,272	22,024
Aug.	11,472	6,775	1,576	2,779	11,130	22,602
Sept.	11,742	7,196	1,498	2,810	11,504	23,246
Oct.	12,220	7,570	1,464	2,888	11,922	24,142
Nov.*	11,707	8,279	1,451	2,975	12,705	24,412

* Preliminary.
Source: Bureau of the Census, Industry Division, Chemicals Branch, United States Department of Commerce

U.S.A. New Supply, Consumption, Exports, and Stock of Reclaimed Rubber

(Long Tons)

Year	New Supply	Consumption	Exports	Stocks
1958	259,809	248,156	11,362	29,063
1959				
Jan.	25,790	25,002	1,157	27,157
Feb.	25,290	24,471	1,041	27,504
Mar.	29,310	27,869	1,375	27,582
Apr.	21,671	22,380	1,225	25,131
May	19,401	20,496	980	23,554
June	26,119	24,998	1,054	23,448
July	27,863	23,942	1,236	25,949
Aug.	25,276	22,914	879	26,165
Sept.	28,123	25,137	937	27,384
Oct.	28,255	26,022	964	27,393
Nov.*	22,525	20,217	....	28,526

* Preliminary.
Source: Bureau of the Census, Industry Division, Chemicals Branch, United States Department of Commerce

U.S.A. Exports of Synthetic Rubber

(Long Tons)

Year	SBR Types	Butyl	Neoprene	N-Type	Total
1958	142,069	13,793	31,337	6,718	193,917
1959					
Jan.	11,962	1,579	3,430	520	17,491
Feb.	11,615	1,169	2,404	648	15,836
Mar.	16,295	2,238	2,712	467	21,712
Apr.	19,154	2,135	3,741	527	25,557
May	12,281	2,587	2,942	642	18,452
June	21,871	2,386	2,522	937	27,716
July	19,814	1,580	4,105	440	25,939
Aug.	18,054	1,896	2,557	1,025	23,532
Sept.	22,506	2,240	4,864	692	30,302
Oct.	13,476	1,383	2,250	679	17,788

Source: Bureau of the Census, Industry Division, Chemicals Branch, United States Department of Commerce

U.S.A. Stocks of Synthetic Rubber

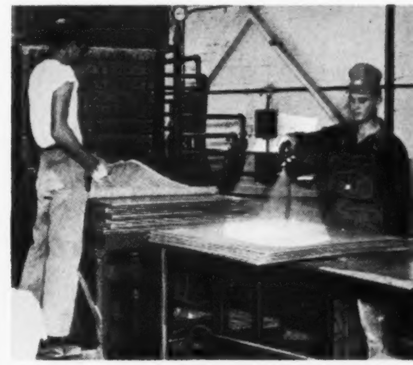
(Long Tons)

Year	SBR Types	Butyl	Neoprene	N-Type	Total
Dec.	143,533	18,770	15,488	7,292	185,083
1959					
Jan.	147,243	16,827	15,638	7,335	187,043
Feb.	148,606	16,339	15,990	7,468	188,403
Mar.	146,971	14,441	14,701	7,753	183,866
Apr.	147,867	12,496	14,848	7,728	182,939
May	156,209	12,710	15,024	7,820	191,763
June	145,486	11,128	14,986	7,969	179,569
July	142,606	9,899	15,187	8,912	176,604
Aug.	148,795	10,558	15,745	8,418	183,516
Sept.	147,400	9,535	12,845	8,526	178,306
Oct.	157,768	10,805	13,385	8,649	190,607
Nov.*	168,490	11,447	13,043	9,077	202,057

* Preliminary.
Source: Bureau of the Census, Industry Division, Chemicals Branch, United States Department of Commerce.

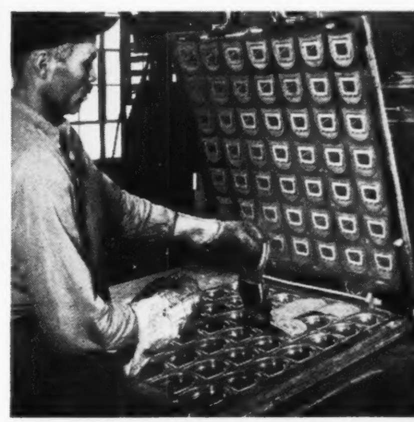
SILICONE NEWS from Dow Corning

Pop Out Perfect Products



Water-dilutable emulsions, solvent soluble fluids, greaselike compounds, different forms for different uses. Whatever you make . . . if it's molded of rubber — you can count on Dow Corning development engineers to formulate a silicone mold lubricant that'll release it efficiently and economically!

More Cost-Saving Silicones . . . In other areas of the rubber industry, too, Dow Corning Silicones have proved to be time and money savers: as electrical insulation



for mill and mixer motors; as anti-adhesive coatings for bags, containers and interleaving; as heat-resistant paints that also resist weathering and corrosive atmospheres; as lubricants for ball bearings; and as Silastic® gums and bases for compounding silicone rubber stocks to meet severe performance requirements. For more information about silicone release agents or other silicones for the rubber industry, write Dow Corning, Dept. 9402.

Dow Corning Silicone Mold Lubricants Assure Finer Details, Fewer Rejects

Toys and dolls, mats and heels, tires and tile — all kinds of rubber products — pop out cleanly, time after time after time, from molds lubricated with Dow Corning Silicones. These silicone release agents give uniform stick-free release . . . assure sharp surface detail, reduce rejects to a bare minimum, increase profits.

Dow Corning mold lubricants help you realize noteworthy savings, too . . . practically eliminate the need for cleaning molds. In turn, mold downtime is reduced . . . service life increased. New production efficiency, better looking products, lower maintenance costs, less waste . . . advantages like these have led more and more molders of rubber products to standardize on Dow Corning silicone release agents.

Easy and economical to use, Dow Corning mold lubricants are available in a variety of forms . . . for all types of rubber . . . for all types of molds.

Your nearest Dow Corning office is the number one source for information and technical service on silicones.

first in silicones

Dow Corning CORPORATION
MIDLAND, MICHIGAN

ATLANTA BOSTON CHICAGO CLEVELAND DALLAS LOS ANGELES NEW YORK WASHINGTON, D. C.

World Consumption of Natural Rubber

(1,000 Long Tons)

Year	United States	Eastern Europe and China	United Kingdom	Other Foreign	Total Foreign	Grand* Total
1958						
Sept.	44.8	49.3	16.8	78.7	145.2	187.5
Oct.	48.9	40.5	14.2	82.1	136.8	185.0
Nov.	43.1	32.7	14.2	78.4	125.3	167.5
Dec.	47.0	46.5	17.0	76.8	140.5	187.5
1958 Total	485.2	427.0	175.5	895.8	1,497.3	1,982.5
1959						
Jan.	50.0	49.6	15.3	77.2	127.2	192.5
Feb.	47.3	29.8	13.8	77.7	117.5	167.5
Mar.	52.0	19.0	15.3	78.8	117.7	165.0
Apr.	41.5	37.8	13.9	80.2	131.0	172.5
May	38.8	41.2	13.8	76.2	131.2	170.0
June	47.8	42.1	18.3	82.4	134.7	182.5
July	47.5	32.7	13.0	79.8	127.5	175.0
Aug.	46.9	16.8	11.0	68.5	98.1	145.0
Sept.	49.3	41.1	18.1	...	...	187.5
Oct.	49.0	...	15.5	...	...	187.5

*Estimated.
Source: Bureau of the Census, Industry Division, Chemicals Branch, United States Department of Commerce; and Secretariat of the International Rubber Study Group.

World Consumption of Synthetic Rubber*

(1,000 Long Tons)

Year	U.S.A.	Canada	United Kingdom	Total† Continent of Europe	World† Grand Total
1958					
Sept.	78.5	4.2	5.8	14.0	110.0
Oct.	88.0	4.1	4.8	14.8	120.0
Nov.	79.0	4.3	5.2	13.8	110.0
Dec.	85.4	4.3	6.2	13.8	115.0
1958 Total	872.2	46.7	63.0	173.0	1,225.0
1959					
Jan.	89.6	4.4	5.8	15.5	122.5
Feb.	87.4	5.2	5.7	15.5	122.5
Mar.	95.1	5.0	7.0	15.8	130.0
Apr.	79.7	5.1	6.2	17.0	117.5
May	74.6	4.8	6.0	15.5	110.0
June	91.7	5.5	8.1	18.5	130.5
July	93.7	4.5	5.4	17.5	127.5
Aug.	91.0	3.4	4.3	13.8	122.5
Sept.	96.9	5.0	8.3	19.2	140.0
Oct.	98.6	...	6.6	...	140.0

*Includes latices.
† Figures estimated or partly estimated.
Source: Secretariat of the International Rubber Study Group; and Bureau of the Census, Industry Division, Chemicals Branch United States Department of Commerce.

U.S.A. Imports and Production of Natural (Including Latex and Guayule) and Synthetic Rubber (in Long Tons)

Year	Natural	SBR Types	Butyl	Neoprene	N-Type	Total Natural and Synthetic
1958						
Sept.	41,343	75,111	4,117	8,586	3,165	132,322
Oct.	45,136	82,741	5,338	9,283	3,619	136,022
Nov.	41,819	84,382	4,145	10,394	3,575	134,647
Dec.	54,491	85,270	3,933	9,201	3,217	156,112
1959						
Jan.	54,950	90,261	4,992	9,991	3,260	163,454
Feb.	48,917	83,067	5,650	10,256	3,324	151,214
Mar.	48,584	91,847	6,056	9,690	3,784	159,961
Apr.	44,347	88,444	6,279	10,455	3,299	152,824
May	45,451	89.625	6,467	10,249	3,610	155,402
June	46,048	87,221	5,583	10,216	3,696	153,124
July	47,527	94,749	6,391	9,365	3,811	161,843
Aug.	45,359	97,113	8,050	10,471	3,397	164,930
Sept.	47,643	97,677	7,399	10,888	3,883	167,490
Oct.	48,378	106,643	7,957	10,099	3,833	176,910
Nov.*	....	101,856	7,523	11,660	3,786	....

*Preliminary.
Source: Bureau of the Census, Industry Division, Chemicals Branch, United States Department of Commerce.

World Production of Natural Rubber

(1,000 Long Tons)

Year	Malaya		Indonesia		All Other	Total
	Estate	Native	Estate	Native		
1958						
Sept.	33.8	23.6	19.0	38.6	167.5	52.5
Oct.	35.1	23.7	20.1	43.4	175.0	52.7
Nov.	31.9	19.8	20.1	43.3	170.0	54.9
Dec.	41.5	30.1	21.5	45.8	195.0	56.1
1958 Total	390.9	272.7	237.4	377.1	1,955.0	676.9
1959						
Jan.	37.6	27.2	20.3	22.4	82.5	190.0
Feb.	27.9	21.2	18.0	29.5	58.4	145.0
Mar.	28.5	21.1	17.4	40.3	45.2	155.0
Apr.	28.9	19.4	15.5	45.2	46.0	155.0
May	33.5	22.4	16.1	51.2	49.3	172.5
June	33.9	24.3	18.3	50.1	38.4	165.0
July	35.7	26.9	18.7	36.0	60.2	177.5
Aug.	36.5	24.9	18.3	43.6	51.7	175.0
Sept.	35.7	26.1	17.5	38.4	52.3	170.0
Oct.	36.0	25.5	18.5	52.5	55.0	187.5

Source: Bureau of the Census, Industry Division, Chemicals Branch, United States Department of Commerce; Secretariat of the International Rubber Study Group.

World Production of Synthetic Rubber

(1,000 Long Tons)

Year	U.S.A.	Canada	Germany	Total
1958				
Aug.	87.3	10.9	2.3	100.5
Sept.	90.9	11.5	2.2	104.7
Oct.	100.9	12.5	2.4	115.9
Nov.	102.5	12.1	3.1	117.7
Dec.	101.6	12.9	2.7	117.3
1958 Total	1,052.8	135.0	22.7	1,210.5
1959				
Jan.	108.5	13.0	2.0	123.5
Feb.	102.3	11.7	2.3	116.3
Mar.	111.4	7.5	3.7	122.6
Apr.	108.5	0.0	3.5	111.9
May	110.0	0.3	3.0	113.3
June	106.7	0.4	4.7	111.5
July	114.3	9.2	3.2	126.7
Aug.	119.0	11.1	4.7	134.8
Sept.	119.8	11.4	4.6	135.9
Oct.	128.5	...	5.1	.....

Source: Secretariat of the International Rubber Study Group; and Bureau of the Census Industry Division, Chemicals Branch, United States Department of Commerce.

U.S.A. Consumption of Natural and Synthetic Latices

(Long Tons, Dry Weight)

Year	Natural	SBR	Neoprene	N-Type	Total Synthetic	Total Natural & Synthetic
1958						
July	4,531	3,433	629	703	4,765	9,296
Aug.	6,094	4,654	764	1,025	6,443	12,537
Sept.	6,748	5,779	820	1,017	7,616	14,364
Oct.	7,725	6,534	979	1,120	8,633	16,358
Nov.	6,540	6,009	798	1,108	7,915	14,455
Dec.	6,820	6,893	805	1,106	8,804	15,624
1959						
Jan.	7,184	6,886	925	1,244	9,055	16,239
Feb.	6,489	7,083	859	1,009	8,951	15,440
Mar.	7,052	7,275	1,054	1,208	9,537	16,589
Apr.	5,793	5,629	1,104	1,169	7,902	13,695
May	5,429	5,962	995	1,112	8,069	14,966
June	5,622	6,497	910	1,150	8,557	14,179
July	5,004	5,804	919	940	7,663	12,667
Aug.	6,613	7,348	961	1,116	9,425	16,038
Sept.	6,342	6,919	910	1,178	9,007	15,349
Oct.	6,153	7,388	969	1,158	9,515	15,668
Nov.*	4,858	6,427	893	981	8,301	13,159

* Preliminary.
Source: Bureau of the Census, Industry Division, Chemicals Branch, United States Department of Commerce.

Carbon Black Statistics—January-November, 1959

Furnace blacks are classified as follows: SRF, semi-reinforcing furnace black; HMF, high modulus furnace black; GPF, general-purpose furnace black; FEF, fast-extruding furnace black; HAF, high abrasion furnace black; SAF, super abrasion furnace black; ISAF, intermediate super abrasion furnace black.

(Thousands of Pounds)

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.
Production											
Furnace types											
Thermal	12,187	11,675	12,469	14,293	14,443	13,375	13,490	14,364	12,912	13,318	12,641
SRF	23,004	21,767	23,108	22,957	23,728	22,925	25,606	23,046	28,146	29,412	26,190
HMF	6,487	5,169	5,694	6,910	5,412	6,043	7,321	7,160	6,768	5,555	6,079
GPF	5,000	5,545	6,942	7,937	8,723	7,849	7,263	9,382	7,457	6,813	6,532
FEF	21,579	19,286	23,372	21,683	20,925	20,955	21,284	21,541	20,896	19,723	19,856
HAF	39,114	37,892	46,534	43,315	45,057	38,694	44,418	45,784	45,359	43,902	42,806
SAF	293	—	—	—	1,656	3,303	618	4	650	2,075	1,104
ISAF	16,605	14,490	19,262	19,770	18,365	16,366	21,133	21,571	20,494	21,735	21,514
Total furnace	124,269	118,824	137,381	136,265	138,309	130,010	141,493	142,852	142,682	142,533	136,722
Contact types	26,890	24,695	28,029	27,624	27,752	26,346	27,076	27,495	26,286	26,477	25,308
Totals	151,159	143,519	165,410	164,389	166,061	156,356	168,569	170,347	168,968	169,010	162,030
Shipments											
Furnace types											
Thermal	12,283	12,658	14,904	13,223	12,313	14,105	12,299	14,242	15,640	13,695	13,848
SRF	26,251	26,009	29,465	24,244	21,012	23,650	25,805	26,811	31,050	27,247	27,722
HMF	6,420	5,122	6,299	5,895	5,748	6,061	7,454	6,579	7,949	5,933	7,333
GPF	6,977	7,245	7,397	8,336	8,375	8,091	8,898	6,781	7,148	7,849	7,055
FEF	24,511	20,924	25,949	19,575	17,558	20,991	22,865	22,163	24,077	20,453	21,255
HAF	45,800	42,890	47,161	40,675	32,238	43,360	49,883	47,625	52,007	45,225	43,441
SAF	615	583	897	553	946	1,543	950	1,147	1,053	1,054	1,488
ISAF	17,391	16,739	19,589	18,934	19,133	19,956	23,399	21,051	23,470	22,897	22,942
Total furnace	141,248	132,170	151,931	131,435	117,323	137,757	151,553	146,426	162,394	144,353	145,084
Contact types	31,852	28,221	29,214	24,453	26,386	25,574	29,207	26,198	35,488	26,914	33,493
Totals	17,100	160,391	181,145	155,888	143,709	163,331	180,760	172,624	197,882	171,267	178,577
Producers' Stocks, End of Period											
Furnace types											
Thermal	23,181	22,198	19,759	20,829	22,959	22,729	23,920	24,042	21,314	20,937	19,730
SRF	35,764	31,522	25,165	23,979	26,842	26,254	26,192	22,585	19,681	21,846	20,314
HMF	6,856	6,903	6,298	7,169	6,686	6,668	6,535	7,162	5,981	5,603	4,349
GPF	7,658	5,958	5,503	5,104	5,452	5,073	3,661	6,085	6,394	5,358	4,835
FEF	17,213	15,575	12,998	15,106	18,473	18,437	16,856	16,234	13,053	12,323	10,924
HAF	38,010	33,012	32,382	35,018	47,837	43,171	37,706	35,838	29,190	27,866	27,389
SAF	5,071	4,487	3,586	3,028	3,738	5,498	5,166	4,023	3,576	4,597	4,213
ISAF	38,708	39,459	38,862	39,698	38,930	35,340	33,074	33,594	30,618	29,456	28,273
Total furnace	172,461	159,114	144,553	149,931	170,917	163,170	153,110	149,563	129,807	127,986	120,027
Contact types	88,646	85,120	83,935	87,098	88,368	89,140	87,009	88,306	78,882	78,445	70,260
Totals	261,107	244,234	228,488	237,029	259,285	252,310	240,119	237,869	208,689	206,431	190,287
Exports											
Furnace types											
Total furnace	29,543	19,442	30,154	29,600	27,123	163,170	30,453	28,201	44,114	25,455	—
Contact types	15,604	12,930	13,037	11,702	14,079	89,140	12,157	12,713	19,031	10,387	—
Totals	45,147	32,372	43,191	41,302	41,202	252,310	42,610	40,914	63,145	35,842	—

Source: Bureau of Mines, United States Department of the Interior, Washington, D. C.

U.S.A. Rubber Industry Sales and Inventories

(Millions of Dollars)

	Value of Sales*				Manufacturers' Inventories*			
	1956	1957	1958	1959	1956	1957	1958	1959
Jan.	415	496	448 ·	508	935	1,047	1,100	1,013
Feb.	445	495	413	490	970	1,036	1,087	1,032
Mar.	451	476	412	506	979	1,030	1,112	1,030
Apr.	445	490	429	543	970	1,031	1,047	1,015
May	464	481	428	524	985	1,024	1,020	995
June	450	458	445	520	975	1,027	986	1,013
July	459	514	478	519	987	1,045	980	1,075
Aug.	436	481	438	492	1,007	1,074	1,024	1,113
Sept.	429	481	464	520	1,007	1,074	1,024	1,134
Oct.	454	490	493	...	1,022	1,097	1,022	....
Nov.	463	431	472	...	1,024	1,101	1,018	....
Dec.	461	427	518	...	998	1,092	994	....
Total	5,372	5,720	5,438	...	Av. 988	12,678	12,414	....

* Adjusted for seasonal variation.

Source: Office of Business Economics, United States Department of Commerce.

U.S.A. Rubber Industry Economic Indicators

	Production Index*					% Return †			
						On Sales		Investment On	
Year	All Rubber Products	Total Tires & Tubes	Auto Tires	Truck & Bus Tires	Miscellaneous Rubber Products	R	R&MP‡	R	R&MP
1958	125	113	120	103	136	3.9	3.5	7.3	7.0
Dec.	137	128	132	122	146	4.5	3.9	9.6	8.4
1959									
Jan.	150	138	149	124	161				
Feb.	158	154	167	137	161				
Mar.	159	155	171	133	163		3.9		8.0
Apr.	138	111	120	99	163				
May	132	108	120	92	154				
June	152	141	154	122	162		4.4		10.4
July	141	147	162	125	136				
Aug.	156	136	148	120	174				
Sept.	161	139	151	124	181		4.1		8.8
Oct.	156	151	157	142	161				

* F.R.B. Index of Industrial Production Unadjusted (1947-49 Avg., 100%).

† Base Data F.T.C.-S.E.C.-Quarterly Financial Reports—% Calculated by RMA.

‡ R = Rubber; R&MP = Rubber and Miscellaneous Plastics, a classification revised according to the 1959 Standard Industrial Classifications.

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CHEMIST AND ENGINEERING TECHNOLOGIST—B.S., Ph.D. level. Long experience in rubber, latex, resins, plastics, and related materials. Pressure-sensitive development and manufacture. Chemical development, engineering, and mechanical experience. Administrative and consulting experience. Patents registered. Mature age. Full time connection or consulting basis considered. Eastern location preferred. Address Box No. 2406, care of RUBBER WORLD.

SITUATIONS OPEN

TECHNICAL SALES, YOUNG MAN CHEMICAL DEGREE WITH 3-5 years' experience rubber compounding. Articulate, with keen desire to sell. Address Box No. 2407, care of RUBBER WORLD.

CHIEF CHEMIST—COMPOUNDER
Rapidly expanding precision molded goods mfr. wants Chief Chemist with experience in high-temperature fuel and oil-resistant stocks. Address Box No. 2408, care of RUBBER WORLD.

PRODUCT DEVELOPMENT
Rubber and Plastics. Chemist or chemical engineering graduate. Some rubber experience necessary. Opportunity for widely varied individual creative work. Send résumé and salary desired to: E. L. Bixby, GOODALL RUBBER CO., Trenton 4, N. J.

PLANT SUPERINTENDENT EXPERIENCED IN HANDLING all types of rubber molding, familiar with compounding, and extrusion operations. Must have strong experience in mold design. The man we are looking for should be aggressive and experienced in labor relations. Address Box No. 2409, care of RUBBER WORLD.

CHEMIST OR CHEMICAL ENGINEER
Several years' experience in the rubber industry on the compounding and processing of all types of rubber polymers in the laboratory and in the factory. Roll covering or mandrel building experience desired, but not necessary. Wonderful opportunity for the right man to be assistant to the chief chemist in this rapidly expanding plant in the East. All replies held strictly confidential. Address Box No. 2410, care of RUBBER WORLD.

MATERIALS & PROCESS RESEARCH CHEMISTS
Research minded, medium-sized company, long recognized as the leader in its field, offers positions in its expanding Materials and Process Research Department. Background experience in all elastomer compounding and development, including polyurethanes, and/or rubber-metal bonding, desirable. Chemistry or Chemical Engineering education required as well as ability to write reports and instruct others. Modern plant located in progressive community. New laboratories with excellent research facilities. Excellent housing available within 10 minutes' driving distance. Call collect or write for application form.
LORD MANUFACTURING COMPANY
Personnel Department
Erie, Pennsylvania

PLANT MANAGEMENT

Experienced staff needed to operate new moulded rubber goods plant in North Mississippi. Applicants for the positions of Factory Manager, Production Superintendent, Industrial Engineers, Plant Engineer, Master Mechanic, Chemists, and Compounders are invited to send confidential resume to:

Personnel Manager
American Biltrite Rubber Co., Inc.
22 Willow Street, Chelsea 50, Massachusetts

SITUATIONS OPEN (Cont'd)

RUBBER TECHNICAL SALES

Openings exist for sales-technical service men in three sales territories. Applicants should possess knowledge of compounding and formulation and preferably should have some experience in production work.

Benefits include contributory retirement, insurance and hospitalization programs. Company car furnished. Send resume and indicate desired salary range to:

Columbia-Southern Chemical Corporation
One Gateway Center—Room 1929W
Pittsburgh 22, Pennsylvania

TECHNICAL SALES—ISOCYANATES
Young Ch. E. or chemist wanted for field sales work requiring some understanding of rubber and plastic technology. Training and introductory period will lead directly to self supervising field selling. We require integrity, intelligence and energy in that order, and offer a permanent position with growth potential. Starting salary $6500 to $9000 for two to five years' experience. Please send résumé to: Richard Kithil, Vice President, THE CARWIN COMPANY, North Haven, Connecticut.

RUBBER CHEMIST
Long-established Rubber Reclaiming Company has opening for Rubber Chemist. This is an excellent opportunity created by promotion. Experience in general compounding and/or processing for product development desirable, but not essential. Pension, hospitalization and other benefit programs above average. Salary commensurate with experience. Send résumé in confidence to Box No. 2415, care of RUBBER WORLD.

The Classified Columns of RUBBER WORLD bring prompt results at low cost.

LATEX AND CUT THREAD TECHNOLOGIST TO HEAD NEW department and also Sales and Consultant help wanted on these products. Address Box No. 2416, care of RUBBER WORLD.

AN EXCELLENT OPPORTUNITY FOR COLLEGE GRADUATE who has had experience in compounding rubber. Capable of supervising, molding and extruding rubber. Progressive company. Employing 50 to 60 men. Rapid advancement. Good starting wages. Fringe benefits. Work with owners. Pleasant surroundings. City 38,000, south central Illinois. Write immediately, if interested. Address Box No. 2417, care of RUBBER WORLD.

SENIOR RESEARCH CHEMIST
Challenging opening on San Francisco Peninsula. Degree in Chemistry or Chemical Engineering. Five to ten years' experience in rubber compounding and production. Record of development in precision molded rubber products. Salary open. Liberal benefits. Replies confidential. Send resume to Box No. 2418, care of RUBBER WORLD.

U.S.A. Rubber Industry Employment, Wages, Hours

Year	Production Workers (1000's)	Average Weekly Earnings	Average Weekly Hours	Average Hourly Earnings	Consumer's Price Index
		All Rubber Products			
1939	121.0	$27.84	39.9	$0.75	
1958					
June	175.8	91.10	39.1	2.33	123.9
July	175.1	91.89	39.2	2.35	123.7
Aug.	181.2	96.80	40.5	2.39	123.7
Sept.	187.5	97.51	40.8	2.39	123.7
Oct.	194.5	97.27	40.7	2.39	123.7
Nov.	195.3	98.09	40.7	2.41	123.9
Dec.	198.2	102.66	41.9	2.45	123.7
1959					
Jan.	199.1	100.28	41.1	2.44	123.8
Feb.	198.8	101.09	41.6	2.43	123.7
Mar.	201.5	103.74	42.0	2.47	123.7
Apr.	176.0	101.57	41.8	2.43	123.9
May	174.3	101.52	42.3	2.40	124.5
June	198.6	98.74	38.5	2.43	124.9
July	199.2	107.10	43.1	2.50	124.9
Aug.	204.3	105.58	42.4	2.49	124.8
Sept.	213.0		41.3	2.47	125.2
Oct.	212.1	....	40.8	2.48	....
		Tires and Tubes			
1939	54.2	$33.36	35.0	$0.96	
1958					
June	71.2	103.63	38.1	2.72	
July	71.0	106.59	38.9	2.74	
Aug.	72.5	113.96	40.7	2.80	
Sept.	74.1	113.40	40.5	2.80	
Oct.	75.3	113.24	40.3	2.81	
Nov.	76.2	115.75	40.9	2.83	
Dec.	77.1	121.40	42.3	2.87	
1959					
Jan.	76.9	117.55	41.1	2.86	
Feb.	76.2	118.98	41.6	2.86	
Mar.	77.9	122.96	42.4	2.90	
Apr.	66.0	123.98	42.9	2.89	
May	50.5	128.77	43.8	2.94	
June	73.0	108.93	34.0	2.94	
July	74.8	128.74	44.6	2.97	
Aug.	78.7	129.06	43.6	2.96	
Sept.	80.3		40.6	2.90	
Oct.	79.8	.....	40.2	2.95	
		Rubber Footwear			
1939	14.8	$22.80	37.5	$0.61	
1958					
June	16.3	77.20	40.0	1.93	
July	15.9	75.25	39.4	1.91	
Aug.	16.4	77.18	40.2	1.92	
Sept.	16.8	76.62	39.7	1.93	
Oct.	17.1	77.01	39.9	1.93	
Nov.	17.2	77.22	39.6	1.95	
Dec.	17.1	78.01	39.8	1.96	
1959					
Jan.	17.1	78.20	39.9	1.96	
Feb.	17.1	80.59	40.7	1.98	
Mar.	17.4	79.79	40.3	1.98	
Apr.	12.9	73.05	39.7	1.84	
May	18.4	79.98	40.6	1.97	
June	18.3	81.58	40.8	1.97	
July	18.2	78.60	40.4	1.95	
Aug.	18.4	79.95	41.0	1.95	
Sept.	19.0	....	39.8	1.97	
Oct.	19.0	....	39.8	1.99	
		Other Rubber Products			
1939	51.9	$23.34	38.9	$0.61	
1958					
June	88.3	83.77	39.7	2.11	
July	88.2	83.53	39.4	2.12	
Aug.	92.3	86.24	40.3	2.14	
Sept.	96.6	89.21	41.3	2.16	
Oct.	102.1	88.78	41.1	2.16	
Nov.	101.9	88.54	40.8	2.17	
Dec.	104.0	92.60	41.9	2.21	
1959					
Jan.	105.1	91.27	41.3	2.21	
Feb.	105.5	91.96	41.8	2.20	
Mar.	106.2	93.02	41.9	2.22	
Apr.	97.1	90.03	41.3	2.18	
May	105.4	92.60	41.9	2.21	
June	107.3	94.98	41.2	2.22	
July	106.2	95.40	42.6	2.25	
Aug.	107.2	93.21	41.8	2.23	
Sept.	113.7	....	42.0	2.25	
Oct.	113.3	....	41.4	2.24	

Source: BLS, United States Department of Labor.

U.S.A. Automotive Pneumatic Casings

(Thousands of Units)

Year	Shipments: Original Equipment	Shipments: Replacement	Shipments: Export	Shipments: Total	Production	Inventory End of Period
Passenger Car						
1958						
Oct.	1,522	5,369	80.6	6,972	7,983	17,134
Nov.	3,056	3,651	57.7	6,765	7,182	17,420
Dec.	3,701	3,977	61.2	7,739	8,046	17,818
1959						
Jan.	2,631	6,028	56.9	8,716	8,859	17,998
Feb.	2,442	4,932	60.2	7,434	8,962	19,435
Mar.	2,930	6,261	61.7	9,253	9,959	20,181
Apr.	3,115	6,390	64.8	9,569	6,986	17,597
May	2,848	5,617	38.4	8,504	6,953	15,721
June	2,904	5,936	46.3	8,886	9,022	16,134
July	3,188	5,988	65.4	9,242	9,857	16,853
Aug.	973	5,721	67.3	6,761	8,458	18,677
Sept.	1,923	5,850	77.4	7,850	8,804	19,636
Oct.	2,628	6,015	78.9	8,722	9,374	20,287
Nov.	1,252	4,161	63.5	5,476	7,088	21,996
Truck and Bus						
1958						
Oct.	316	1,106	59	1,482	1,361	2,779
Nov.	313	669	42	1,023	1,211	2,983
Dec.	356	734	63	1,153	1,330	3,171
1959						
Jan.	329	714	47	1,090	1,325	3,401
Feb.	364	679	74	1,117	1,308	3,584
Mar.	406	842	56	1,304	1,391	3,680
Apr.	479	907	44	1,430	1,039	3,276
May	442	738	41	1,222	943	3,006
June	488	820	44	1,352	1,272	2,954
July	400	844	47	1,290	1,366	3,023
Aug.	276	874	46	1,196	1,225	3,054
Sept.	422	969	58	1,448	1,299	2,906
Oct.	338	1,151	57	1,546	1,510	2,864
Nov.	189	737	56	981	1,259	3,137
Total Automotive						
1958						
Oct.	1,838	6,476	140	8,454	9,344	19,913
Nov.	3,369	4,320	100	7,788	8,393	20,403
Dec.	4,057	4,711	124	8,892	9,376	20,988
1959						
Jan.	2,961	6,742	104	9,806	10,184	21,399
Feb.	2,805	5,611	135	8,551	10,270	23,019
Mar.	3,336	7,103	117	10,557	11,350	23,862
Apr.	3,594	7,297	108	10,999	8,025	20,872
May	3,291	6,356	79	9,726	7,796	18,727
June	3,392	6,756	90	10,237	10,294	19,098
July	3,588	6,832	112	10,532	11,223	19,877
Aug.	1,249	6,595	114	7,957	9,683	21,730
Sept.	2,345	6,819	135	9,298	10,103	22,542
Oct.	2,966	7,166	136	10,269	10,884	23,151
Nov.	1,440	4,898	120	6,458	8,347	25,133

Source: The Rubber Manufacturers Association, Inc.

U.S.A. Automotive Inner Tubes

(Thousands of Units)

Year	Shipments: Original Equipment	Shipments: Replacement	Shipments: Export	Shipments: Total	Production	Inventory End of Period
1958						
Sept.	207	3,228	63	3,498	3,390	7,657
Oct.	244	3,237	84	3,567	3,768	7,869
Nov.	264	2,575	60	2,899	3,319	8,372
Dec.	288	3,029	94	3,411	3,491	8,617
1959						
Jan.	287	4,450	63	4,800	3,806	7,536
Feb.	311	3,924	81	4,316	4,094	7,364
Mar.	339	4,013	83	4,435	4,459	7,629
Apr.	389	3,473	65	3,928	3,380	7,218
May	363	2,853	59	3,275	2,752	6,849
June	392	3,421	59	3,872	3,683	6,999
July	317	3,564	66	3,948	4,345	7,560
Aug.	210	3,297	77	3,583	3,716	7,848
Sept.	347	3,258	88	3,693	4,065	8,334
Oct.	265	3,571	79	3,915	4,392	9,088
Nov.	163	2,867	67	3,097	3,756	9,918

Source: The Rubber Manufacturers Association, Inc.

U.S.A. Production of Cotton, Rayon, and Nylon Tire Fabrics

(Thousands of Pounds)

	Cotton and Nylon*			
1958	Cotton Chafer Fabrics and other Tire Fabrics	Cotton and Nylon Tire Cord and Fabrics	Rayon Tire Cord and Tire Cord Fabric	Total All Tire Cord and Fabrics
Jan.-Mar.	9,750	18,820	66,830	167,924
Apr.-June	7,890	24,725	49,454	80,533
July-Sept.	7,999	24,904	†	91,984
Oct.-Dec.	10,533	26,392	71,827	107,532
1959				
Jan.-Mar.	9,163	32,402	77,307	122,661
Apr.-June	7,699	29,403	76,265	116,965
July-Sept.	8,318	31,545	76,671	119,748

* Cotton and nylon figures combined to avoid disclosing data for individual companies.
† Not available.
Source: Bureau of the Census, United States Department of Commerce.

New Products

(*Continued from page 620*)

on the top side). The maximum permissible angle of inclination is 15 degrees for ascending conveyors and 12 degrees for sloping conveyors.

The fields of application for this type of passenger conveyance include tunnels to and from railway stations; between different levels in subway stations; at industrial, municipal, or commercial enterprises; and at airports or arenas.

New Plastic Safety Suit

Safety First Supply Co., Pittsburgh, Pa., has introduced a new all-purpose disposable plastic safety suit designed to protect workers in all industrial operations involving exposure to chemicals, water, and excess dust or dirt.

This lightweight plastic suit is resistant to most acids and alkalies and fire as well as being waterproof and unaffected by oil or grease, it is claimed. The light yellow poly (vinyl chloride) slip-over jacket and trousers fit comfortably over ordinary work clothing. Elastic tape at neck, wrists, and ankles insures a tight fit for additional protection against dust, sprays, and splashes.

According to Safety First, the suit is the first safety garb of its kind priced low enough to be easily and economically disposable.

Further information and quantity prices are available from the company.

Floor Master Protector Mats

Doan Mfg. Division, Cleveland, O., is unveiling a new line of custom-fitted Floor Master Protector Mats for U. S. compact cars as the principal feature of its booths at the New York IASI Show during February. Available in black and white, the compact car mats are designed to enhance harmoniously colors and interiors of the new cars.

The custom-fitted front door-to-door mats have been designed expressly for the Corvair, Falcon, Valiant, Rambler, and Lark. Each mat is packed in an eye-catching carton with clearly marked identification for each of the compacts.

Doan has long been a supplier of protector mats for imported cars, and station wagon decks, as well as full replacement felt-backed mats for passenger cars and trucks. Introduction of the Floor Master Protector Mats for compact cars, serves to complete the lines for all makes and models of cars, according to the manufacturer.

MACHINERY & SUPPLIES FOR SALE (Cont'd)

FOR SALE—1—16″ x 40″—2-ROLL MILL, M. D. 1—6″ x 12″ LAB calender, M. D. 1—32″ x 32″—2-opening hydraulic press, 16″ ram. 1—4′ x 12′ vulcanizer, Q. O. door.

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FOR SALE: 1—BAKER-PERKINS 100-GAL. SIGMA-BLADE MIXer; 1—Baker-Perkins, size 16 TRM, 150-gal. double-arm, Vacuum Mixer; 1—Ball & Jewell Rotary Cutter; Powder Mixers; Tablet Presses; Screens. Your inquiries solicited. BRILL EQUIPMENT COMPANY—35-65 Jabez Street, Newark 5, N. J.—Tel. MArket 3-7420.

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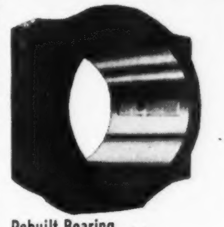

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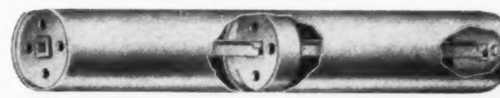

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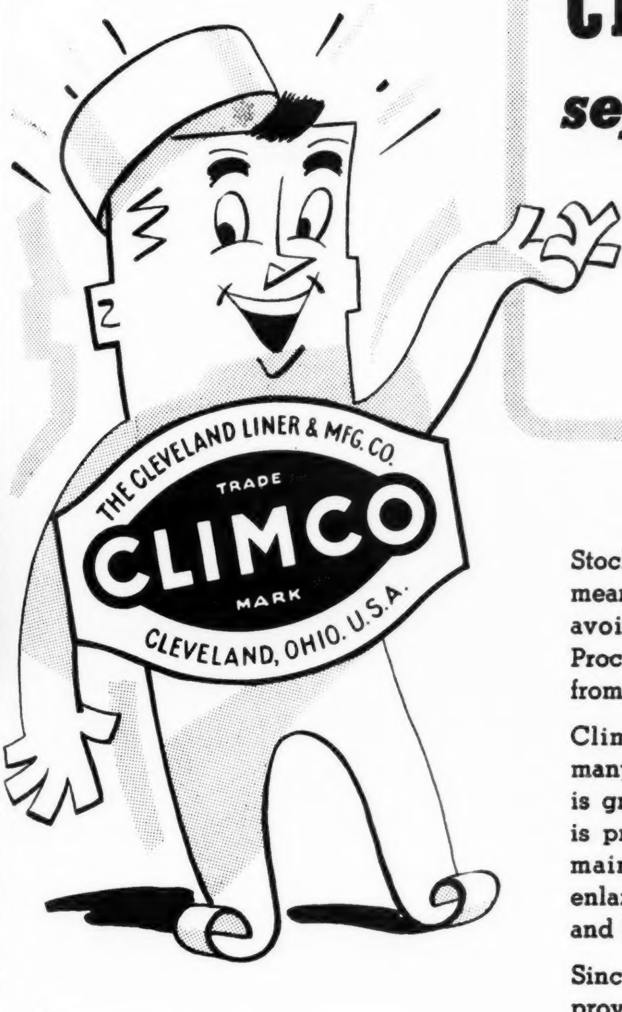

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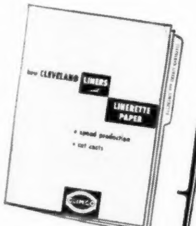

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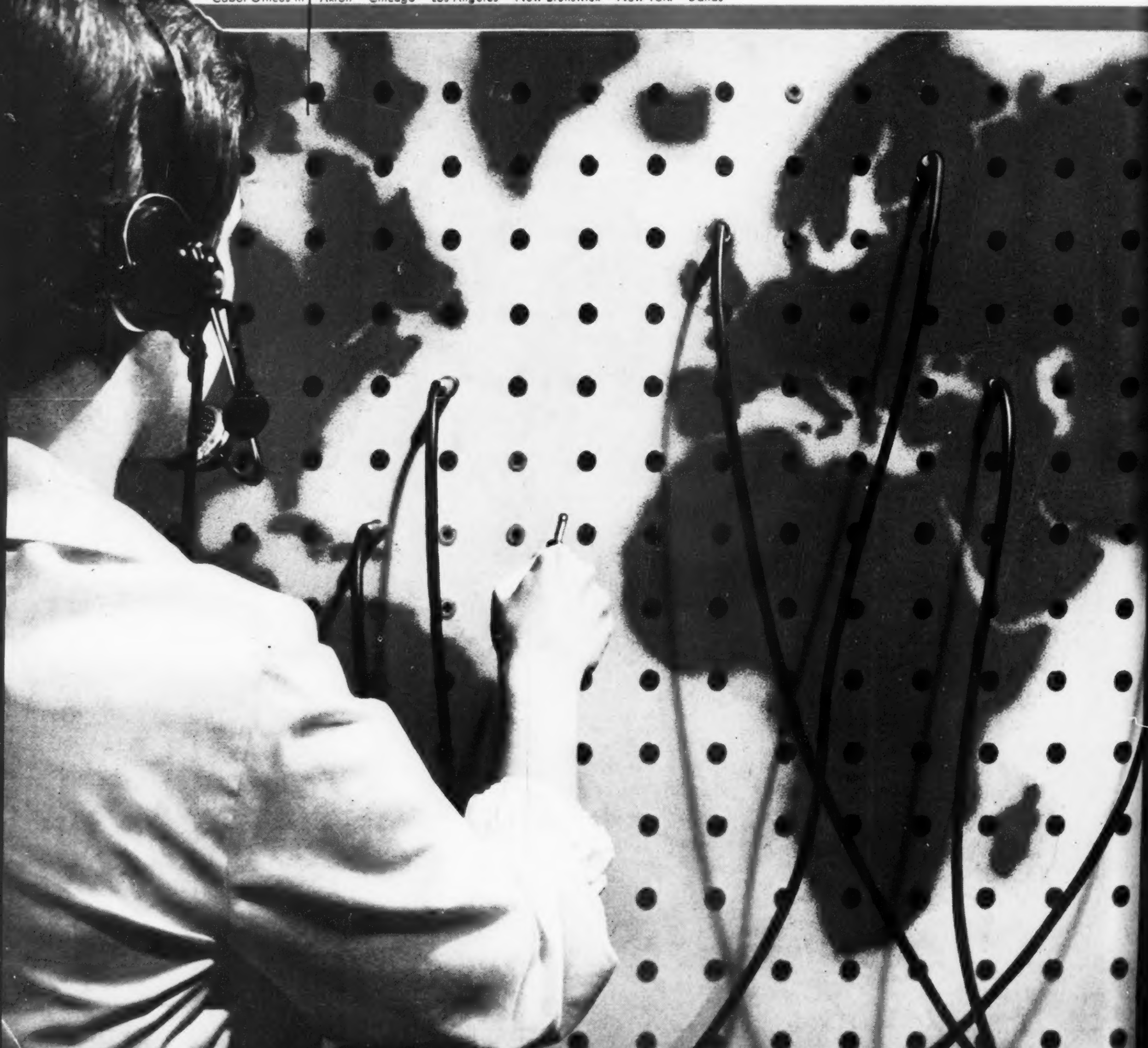

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